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COAL SPECIFICATIONS.

As will be noted elsewhere, specifications have been prepared by U. S. Government engineers to apply in the purchase of coal, which specifications have been adopted by several of the National Government Departments as part of their fuel proposal form. This is an indication of a movement which, though slow in advance thus far, promises in time to establish a practice under which large users of steam power will specify the thermal and other economic values of fuel, and by test on samples determine if the requirements are satisfied, in the same manner that manufacturers specify and test the materials purchased that enter into their output. It is certainly inconsistent to purchase a steam engine on guarantees fixing the consumption of steam within limits of a tenth of a pound, and then give little or no attention to the quality of fuel, variations in which may affect the evaporation more than a pound of steam per pound of coal. Since the value of fuel even from the same mine may vary considerably at different workings and at different cross-sections of vein, a hard and fast fuel as to thermal value and percentage of ash would almost inevitably become a source of trouble. The government specifications therefore appear to be eminently wise in declaring a standard and then allowing a premium where this standard is exceeded and exacting a forfeit where it is not attained. The object of the specifications, moreover, is not to establish an absolute standard of fuel, which would limit the sources of supply for government use, but to fix a fair one for a given fuel and then, even though the standard be low, give the seller the benefit of any excess, and in case of deficiency, place the penalty where it belongs. As the government is a large user of coal, the effect of these specifications will probably in time be to fix quite exactly the relative money value of different grades of coal, which at present is only very roughly recognized. In view of the fairness of the principles on which the specifications are established, opposition to them by any mine owners will be apt to awaken a suspicion that they do not want their product to be subject to a plan which would fix its relative market value. As users of coal, central stations will be largely benefited by the ratings of fuel which the government specifications will thus establish, and the larger plants might well consider the advisability of adopting the specifications for their own use in purchasing fuel.

HIGHER TELEGRAPH RATES.

The telegraph companies have made an announcement of a sharp advance in their rates, taking effect immediately. Some of the rates are put up from 30 to 66 per cent, but it is asserted that the average increase is not more than 2 per cent. But it will be fully 66 per cent to the man who uses that particular service, and if the net gain were only 2 per cent neither company would have bothered to make the change. It will be in-

teresting to see what difference is made in the income at the end of the year.

Such an advance in telegraph rates was to be expected, although the fact must not be overlooked that every other electrical service of late years has undergone marked and even extraordinary reduction in cost, although all the other public utility companies have had to sustain exactly the same additional expenses at the telegraph systems. Street car travel is much cheaper, by distance and transfer. Electric light and power rates have been cut in two, and better. Telephony was never so cheap as now. An adequate explanation is therefore rather hard to find for the fact that even upon their present capitalization the land telegraph lines of the United States earn barely a low dividend and leave little surplus for reserve and renewal. Perhaps President Clowry puts his finger on the reason for the contrast when he says: "The truth of the matter is that 99 per cent of the messages transmitted now are transmitted in the same old way that was in operation in the days of Morse. The system is not changed except that the output per operator is not nearly so great as it used to be. On through circuits, the number of ten-word messages sent by an operator is on an average about 17, while in former years, it was 25. Why this is we cannot say, but it is true." Such being the facts of the case, why not give the Rowland, Buckingham, Murray, Barclay, and Delany systems, a real, full sized, thoroughgoing opportunity to displace the expensive and inefficient manual labor of to-day, under which the companies have virtually or relatively been drying up?

The Central Station and the Electric Vehicle

As pointed out in an article in this issue, a promising, and as yet almost undeveloped, field for central station service is to be found in the charging of electric vehicle batteries. It would be incorrect to say that the uncontrolled use of electricity from lighting circuits for battery charging will under all conditions prove advantageous from the point of view of the central station, but it cannot be denied that a long-hour load, such as battery charging under any conditions, is desirable provided only that it does not add to the evening peak. Many progressive central stations have encouraged the use of electric vehicles by offering a low rate for charging energy, and have sought to eliminate the battery load from the lighting peak by inserting in the contract for energy certain clauses as to the period during which electricity may be taken from the lighting mains. Although excellent results have been obtained from the policy here outlined and few complaints have arisen as to the methods pursued, yet the temptation to charge the batteries during the evening hours has often proved too great to be voluntarily resisted, and the restricting clauses in the contracts have not always been rigidly lived up to. It would seem that absolute satisfaction to all parties concerned can only be obtained by employing special circuits for the battery current, and placing the switch controlling these circuits under the immediate charge of the central station company. With absolute control over the charging circuits, the central station company can well afford to place a low rate on the energy consumed, while the low rate for energy should offer sufficient inducement to the vehicle owner to justify the rigid restriction of the hours during which the electricity may be used.

Measurement of Transformer Core-Loss at Low Frequencies.

An interesting and apparently new method of measuring the hysteretic core-loss of a transformer experimentally, at a very low frequency, so as practically to exclude eddy-current core-loss, is published by Dr. Gisbert Kapp in *The Electrical Engineer*, of London, for Feb. 15, as abstracted elsewhere in the Digest. The method which has generally been used for this purpose is to pass through the primary winding a direct-current so varied in time-value as to keep the unidirectional induced e. m. f. in the secondary winding constant at a suitably low value, perhaps a few centivolts. The strength of the slowly rising primary current necessary for this purpose is noted at, say, five-second intervals. With constant induced secondary voltage during the run, the magnetic flux in the core must increase steadily with time at a determined rate, so that a curve can be plotted between magnetic flux and rising current. Two such curves in a cycle of successively reversed applications of direct current to the primary winding will present a hysteresis loop. The area of the loop, as measured by a planimeter, will enable the cyclic hysteretic loss of energy in the core to be computed. At least two observers are required for the execution of the test, and four are desirable, one to adjust and vary the current in the primary circuit, one to call out five-second time intervals, one for reading the ammeter at each such interval, and one for recording the observations.

The modification suggested by Dr. Kapp consists in maintaining a substantially constant unidirectional e. m. f. impressed upon one winding of the transformer and observing the current at successive time intervals after that impressed e. m. f. has been cyclically reversed. It is quite possible for one observer to carry out the test with the aid of a stop-watch, by measuring in a number of successive cycles the time required to reach determinate current strengths. A curve can thus be plotted between current and time. The area enclosed between this curve and coordinate boundaries enables the hysteretic loss of energy per half-cycle to be computed. The Kapp method has the advantage, therefore, of being capable of execution by a single observer. When a direct-current is sent through a transformer winding, there exists a certain well known relation between the impressed voltage, the current and the rate of change of the flux. Theoretically, any one of these three variables may be maintained constant by suitable hand regulation. The convenience of the corresponding process may determine which of the three is to be selected for this purpose. In the Scott method mentioned above, it is the rate of change of flux that is maintained constant. In the Kapp method, it is the impressed e. m. f. that is kept constant. A third method, as yet unclaimed, might maintain the current constant, and measure either the induced voltage or the impressed voltage. The Kapp method has the advantage that by using the potentiometer principle, a constant impressed e. m. f. is more conveniently obtained than is a constant induced voltage, or the rate of change of the flux. It is possible in any of the above ways to measure the hysteretic core-loss in a transformer separately, eliminating the eddy-current loss, but we have no method as yet available for measuring the eddy-current loss separately, eliminating the hysteretic loss. All we can do, at present, is to vary the frequency or the alternating voltage on a transformer, and observe the change in core-

loss, so as to differentiate, by computation, between the hysteretic and eddy-current losses.

Lightning and Lightning Protection.

The three Institute papers read last week are of particular interest as showing the modern view of disturbances upon electric circuits. The standpoint with respect to lightning has steadily been changing under the effect of added experience. It was not many years back when lightning was thought to be a relatively high-frequency discharge. Error dies hard, and we note even in one of the papers before us an injunction to ground arresters through flat copper strap with few bends. It is now apparent that a really oscillatory lightning discharge is rather the exception than the rule, and that the normal type of discharge is practically a tremendous impulse, at times perhaps with a very steep crest but in itself dealing in the main only one tremendous blow. Dr. Steinmetz, whose analysis of the various elements doing duty as lightning on the line is very keen, even goes so far as to say that a direct stroke of lightning upon the line exerts very considerable power only locally, and is unlikely to do damage after traveling any considerable distance. The evidence of experience is in part rather confirmatory of this view, but its exact bearing is hard to estimate on account of the extreme difficulty of discriminating between primary and secondary effects—of distinguishing the instantaneous blow delivered by the lightning from the immediately subsequent impulses.

When a direct lightning flash hits a line the local effects include breaking of insulators or splintering of poles and cross arms incidental to the passage of the discharge to earth. These injuries may be confined to a few poles or may extend to all the poles over half a mile or more, the damage usually decreasing with the distance from the center of shock. Now the absence of visible damage on the line beyond this directly affected region merely means that beyond such limits the discharge has become sufficiently attenuated to be unable, for example, to splinter a pole by a twenty or thirty-foot leap along it earthwards. There still remains, however, a very formidable wave running outwards and much less rapidly attenuated than in the earlier and more destructive stages of its progress. It is rare to find a line hard hit without there having been simultaneous severe disturbances of the station even at a distance of some miles. Even if the primary wave is frittered away or is in the main discharged to earth without traveling far, the momentary presence of this terrific impulsive electromotive force on the line stands an excellent chance of starting dangerous surging capable of disastrous direct and indirect results at distant points. A direct stroke is, therefore, much to be feared, although it is rare compared to the impulses due to ordinary electrostatic induction which make up the great bulk of the disturbances classified as lightning. Serious damage to the plant is nearly always self-inflicted, the extraneous disturbance being only sufficient effectively to break down the insulation.

As to means for preventing damage from lightning, using the word in its broadest sense, there is still much to be learned in spite of the highly instructive papers before us. We wish we could speak of the grounded guard wire with the same conviction held by Messrs. Rushmore and Dubois. That it is of some use may be freely admitted; that it is of enough use to be worth adopting generally is a question regarding which there is a good deal of debate among practical men. We certainly cannot endorse the statement of Messrs. Rushmore or Dubois that "Practically complete protection for wood-pole transmission lines can be effected against disturbances from atmospheric lightning." The pole devices they show are ingenuous but rather of theoretical promise than of practically proved efficacy. Nature is not good-natured enough to provide experimental doses of lightning to order, and that a particular pole line protected in some especial way has been exempt from trouble proves nothing whatever. If every pole line so protected was exempt from trouble when all other conditions would point to danger, it would still prove nothing during a single season. As a matter of fact, some transmission lines equipped only with rather old-fashioned lightning arresters have pulled through year after year without damage, while others apparently much better equipped have been shut down over and over again. A lightning rod on every pole is a good thing, provided the lightning will kindly confine itself thereto. The experience of many years with lightning rods elsewhere indicates that the bolts of Zeus sometimes meander meekly from conductor to conductor, but more often fall with irresponsible violence on conductors and non-conductors alike.

The practice of recent years in lightning arresters has been in large measure along the line of selective shunting of gaps in series. The scheme is a sound one in that high-potential phenomena requiring no high conductance to ground are disposed of without danger of a distinctive following short-circuit. Whether a plurality of shunts to earth, each with a difference series resistance, has any material advantage is another matter. This multiplicity savors a little of the tale told of Newton who cut two holes in his study door—a largish one for a dog and a little one for a cat. The crux of the whole lightning arrester problem is to stop the tremendous discharge that follows the opening of a low resistance path to earth. Up to the present time no apparatus has been able to do this with any certainty, whether the initial break has been due to lightning or to surging, which latter in one form or another is much commoner than lightning. Some of the big transmission systems have wrecked the most cunningly devised multi-gap arresters pretty nearly by the carload, although elsewhere they had apparently done excellent service. We must own to considerable interest in Mr. Creighton's account of the liquid arrester electrode, as opening a new and rather promising field of operations. The ordinary spark-gap arrangements seem to have inherent limitations which possibly the liquid arrangement may escape. It certainly appears to have remarkable powers of choking back current and of avoiding the surges always to be dreaded as part of the results of a discharge over an arrester. If the liquid arrester can make good in practice its theoretical promise it will mean a long step ahead.

Aside from this we are inclined to attach very considerable importance to what Dr. Steinmetz calls restructive measures, designed to limit disturbances and to prevent one from initiating another, as so often happens. It ought to be possible to rid a system of most of its high-frequency effects by proper discharging and damping devices. Some work in this line has been done abroad

already, and it should be vigorously followed up. Another point made by Dr. Steinmetz is the desirability of intimate study of the electrostatic and electromagnetic details of a system to facilitate symtomatic treatment of the possible ills. The effects of apparatus on the system also deserves close attention, since although normally harmless they may under unusual conditions be serious causes of danger. In recent years, perhaps, the greatest relief from abnormal potentials has been the general increase in working voltage and the consequent improvement of the factors of safety with respect to secondary disturbances. A line and system well insulated for 50,000 volts has a good deal more absolute reserve dielectric strength than one insulated for 25,000 volts at a similar factor of safety. An increment of strain due to lightning, for example, which would break down the latter system, might not affect the former in the least. The extraneous potential differences due to atmospheric causes are not in any way proportional to the working voltage, so that a high-voltage line generally has more reserve strength to withstand them than a low-voltage line. In addition, the former is, for equal energy, less liable to surging of a serious kind, so that high voltage has some material advantages beyond mere economy of copper.

The 1907 Flatiron Season.

The electric flatiron has now become such an established and generally recognized source of central station income that special mention of it hardly seems necessary. Nevertheless, because it is such an important factor in getting more revenue from residence, it is certainly in order at the beginning of another season to urge central station companies which have not already done so, to make plans for pushing the electric flatiron business during the coming warm weather. Irons can be pushed the year around, but by far the greatest returns for a given amount of effort can be obtained during warm weather. In fact some companies relax active efforts altogether during the winter. The time that a company putting out irons on free trial should be prepared to flood the town with them, is at the beginning of the hot weather after housekeepers have experienced one or two ironing days in a hot kitchen with the outside temperature more than hot enough for comfort. More central station companies than heretofore are adopting for the coming season plans for loaning irons. By such methods irons can be introduced much more rapidly than if the customers purchase outright, and many companies are beginning to consider that an investment in irons to be loaned pays remarkably good interest on the money. We anticipate during the next two years a marked increase in the number of companies adopting the loaning policy because the iron usually earns its first cost in a comparatively few months.

The Size and Height of Lighting Units.

In the lighting of large exteriors the question frequently comes up as to the best size of lighting unit to employ. There has been a notable tendency recently to scatter small or medium sized units (say of 125 watts) over the area to be lighted rather than to depend on large units at infrequent intervals. The question nearly always coming up for consideration is how small subdivisions of light is it profitable to make. The objects of subdivision are three-fold: First, to bring the sources of light more nearly over the area to be lighted and hence increase the efficiency; second, to avoid the blinding effect of the larger units, which is both injurious to the eye and detracts from the apparent value of the illumination in a room; and third, to reduce annoying shadows to a minimum. The temptation to use large units in the past has been strong for two reasons: First, the large number of outlets required for lighting by scattered small units, which made the cost of installation high; second, the efficiency of the larger units, such as arc and Nernst lamps, has been considerably better than for the small common incandescent lamp. The introduction of high-efficiency incandescent lamps of 40 mean spherical candle-power and over has caused the adoption of a kind of compromise in some recent work. Some will maintain that for the lighting of large interiors no unit of less than 60 mean spherical candle-power is to be considered. Some would place the limit higher than this, while others would advocate as low as eight candle-power if the expense of outlets was not prohibitive. Those advocating the latter would, of course, put it purely on the ground of avoiding the combination of quantity and high intrinsic brilliancy, which makes large lighting units blinding and injurious. In considering a question of this kind, it must always be remembered that the greater the height of the lamps above the floor, the larger the lighting units can be made without sacrificing too much. The higher the lamps are placed the smaller become the variations in foot-candle intensity at points midway between lamps as compared with points directly under lamps, due simply to the geometric fact that the variations in the distances to the light sources from points on or near the floor of the room are less with lamps placed high than with lamps placed low. From this we can also deduce the fact that with lamps high we do not necessarily sacrifice so much illumination by using large units as we would if lamps were placed low—using here the term "illumination" in the sense of foot-candle illumination on a plane near the floor where the light is most wanted. The blinding effect of the large units is considerably reduced when they are placed very high. Annoying shadows are also less with units high than low. Taken altogether, the general conclusion is reached that the higher the lamp can be placed the larger the lighting units can be made without violating the principles of good illumination. If placed very low, the smaller the better.

Factors in Central Station Growth.

So much has been said about growth of central station business recently, and so much has been accomplished by more progressive stations, that it is occasionally of interest and value to stop and analyze the various causes which may be at work in forwarding this advance. It is especially interesting to do this because (as has been recently pointed out) a larger percentage of the business of the best paying central station properties is that which is secured by an aggressive new business campaign rather than the business which comes in natura. course. Many central station companies which have been letting their business grow naturally are earning only $2 or $2.50 per capita, whereas those which have gone out to capture all the paying business in sight have pushed this figure up to $6, $7 or $8 per capita. Analyzing the causes which make it possible for central stations to grow, we find one to be increase in population. Nevertheless it is well known that there are certain sections in the Middle West where the population of many towns is almost at a standstill, and country population is showing a

slight decline because of emigration further west; yet conditions are most prosperous. This leads us up to the second and very important factor in central station growth, namely, the increase in wealth per capita. If a prosperous country rich in natural resources shows a decrease in population, there is likely to be an increase in wealth per capita; that is, the people remaining in the community have more money to spend and hence the possibility of greater income to the central station. This condition operates to increase the business in two ways—by making customers already connected more liberal in the use of current, and by making it possible to get new customers. These, briefly, are the natural causes which go to increase central station earnings. Among the artificial stimulants can be enumerated lower rates, solicitation, advertising and the introduction of new appliances, although the latter might perhaps better be classified as a natural cause. There is or should be a constant increase in the common standard of illumination; that is, a demand to have stores, houses and public places better lighted. As fast as people can afford more light, they buy it. A well-lighted room of fifteen years ago would not be considered well-lighted to-day. Power from small motors is being used where hand and foot power were formerly prevailing. The small motor is also supplanting the small steam and gasoline engine.

Directed Versus Diffused Light.

The question of direct versus diffused light has come up in a number of interesting ways in the discussions of the Illuminating Engineering Society the past few months. Directed light may be considered as that which comes directly to the surface illuminated from the sources of light or from the reflectors and globes surrounding them. Such rays of light proceed in such well-defined directions as to cause shadows behind the objects upon which they fall. Diffused light may be considered as that coming from such large surfaces and at so many different angles that its rays have no definite directions. As examples of directed lighting offices and factories may be cited where the lighting is entirely by incandescent lamps covered with opaque reflectors which direct the light on the work underneath so that practically all of the light received on any particular working surface is that directed from one or two individual lamps. As examples of diffused lighting are the comparatively few cases where lamps are concealed behind a cornice in a cove and the entire lighting of the room is accomplished by diffuse or irregular reflection from the ceiling. As the ceiling is not a perfectly smooth surface, the rays reflected from it take a great variety of directions with the result that a room lighted by indirect or diffused light is notable for almost an entire absence of shadows. Indirect lighting of this kind has always been admittedly expensive in operation; in fact, too expensive to be considered in the majority of cases, as it requires over three times as much energy to produce a given result as well-designed directed lighting. It has, however, by many been considered as an ideal method if it were only less expensive. In fact, many who have given matters of illumination some thought have so expressed themselves in the past.

Indirect lighting or lighting entirely by diffusion, has, however, received some very severe treatment recently in the discussions of the Illuminating Engineering Society. Nor does this poor opinion of indirect-lighting seem to be confined altogether to engineering circles, as a Chicago architect at the February meeting of the Chicago section of the society firmly took the stand that people do not like the strange and unusual effect of diffused lighting, and that light coming from "nowhere in particular" is not pleasant, because it is unusual. In the paper recently presented before the society by Mr. E. A. Norman, in which the results from the indirect lighting of a certain room were discussed, attention was called to the fact that not only was the indirect lighting extremely uneconomical, but that it was not agreeable to the occupants of the room. This sensation of discomfort in a room lighted in this way seems to have been noticed by others and was commented upon repeatedly in the Chicago discussion of the paper. As to just what constitute the objectionable or disagreeable features of indirect lighting there have been a number of explanations. The essential fact, however, is that many have united in condemning it as unpleasant. If it is both uncomfortable and inefficient, there would seem to be little excuse for its existence. Some have claimed that the absence of shadow in any illumination is so unusual as to produce a ghastly effect. Perhaps it would be better stated that the absence of shadow with artificial illumination is unusual, because we have outdoors on every cloudy day an example of nearly shadowless natural lighting. Some shadows are, however, expected in artificially lighted rooms. Another explanation of the disagreeable effect is that the eye glances to the walls and ceiling for rest and if ceilings or walls are more brilliantly lighted than nearby papers or objects upon which work is being done, the eye is fatigued rather than rested. Another explanation is that with indirect lighting the light reaches the eye from so many directions and from such a large expanse of surface that the eye cannot get away from it and seeks a resting place in vain.

It is the work of the illuminating engineer in artificial lighting to secure the right proportion between directed and diffused lighting. In the great majority of cases, diffused lighting is sufficiently taken care of by reflection from walls and ceilings. As a matter of fact, in the past there has been considerably more lighting by reflection from walls and ceilings than was consistent with good economy; in other words, too large a percentage of the total light given out is allowed to go in the directions of the walls and ceilings, there to be reflected and re-reflected in an inefficient manner, till it reaches the working surface in the lower part of the room. If more of it were directed where needed, there would not be the necessity for the present awakening about securing better illuminating results. On the other hand, there is no question that directed lighting may be overdone. Light coming from a single source on a piece of work or a reading page should come from the proper angle, because if it does not, annoying shadows or annoying glisten or glare on the paper or work will result. In lighting large interiors where many persons are working, it is a matter of great difficulty to place each individual lamp in just the right position to illuminate each person's work by any scheme of directed lighting pure and simple. The tendency is, therefore, more and more to provide a general illumination sufficient for all purposes in such office rooms rather than to depend on individual lamps with directing reflectors covering a small area. Individual lamps afford the least costly method, but at the expense of a lower working efficiency of the whole office or shop force, and hence with a total result that is too costly.

Dedication of the Engineering Societies Building.

Subjoined is given the programme for the exercises in connection with the dedication of the Engineering Societies Building. Announcements have already been made in these pages as to the meetings that will be held during the same week of the American Society of Mechanical Engineers and the American Institute of Mining Engineers. It is likely that other arrangements will also be made. The exercises begin on April 16, at 3 p. m., as follows:

1. Music. 2. Opening—Mr. Charles Wallace Hunt, presiding officer. The first use as a gavel of the setting maul employed by Mrs. Carnegie in laying the corner stone of the building. 3. Prayer by the Rev. Edward Everett Hale, Chaplain U. S. Senate. 4. Communications from the President of the United States; President of the Republic of Mexico; Governor-General of Canada. 5. Historical address by Charles F. Scott, chairman of the conference and building committees. 6. Acceptance of the building by E. E. Olcott, president of the United Engineering Society, representing the Founder Societies. 7. Address by Andrew Carnegie, the donor of the building. 8. Music. 9. Oration by President Arthur T. Hadley, of Yale University, "The Professional Ideals of the Twentieth Century." 10. Music.

Evening Exercises, First Day, Reception, 9 p. m.-10:30 p. m. General reception in the main auditorium; 10:30-12:00, reception by the officers and councils of the Founder Societies in their respective headquarters or floors. Refreshments will be served during the evening on the fifth floor. It is believed that the associated societies may also hold receptions in their respective headquarters during the evening. There will be music on two or more floors throughout the evening.

Second Day, Wednesday, April 17, 2:30 p. m. 1. Introduction by Mr. J. W. Lieb, Jr., chairman of dedication committee. 2. Addresses by presidents of founder societies; Dr. Samuel Sheldon, president A. I. E. E.; Dr. F. R. Hutton, president, A. S. M. E.; Dr. John Hays Hammond, president, A. I. M. E. 3. Greetings and felicitations from foreign and national scientific societies and institutions of learning. 4. Address by Dr. James Douglas, past president, A. I. M. E. 5. Presentation of John Fritz Gold Medal to Dr. Alexander Graham Bell, by Mr. Charles F. Scott, chairman, John Fritz Medal Board of Award. 6. Presentation of medals for distinguished services to Mr. R. W. Pope, secretary, A. I. E. E.; Dr. F. R. Hutton, past secretary, A. S. M. E.; Dr. Rossiter W. Raymond, secretary, A. I. M. E. (By Dr. A. R. Ledoux, past president, United Engineering Society).

Revision of National Electrical Code.

The fifteenth annual meeting of the Underwriters' National Electric Association was held March 27 and 28 in New York. In attendance and discussion the meeting was, perhaps, the most successful thus far held by the Association. One of the important actions was the appointment of a committee to consider the advisability of rearranging the Code. A committee was also authorized to formulate rules on electric cranes, which, if adopted, will appear in the 1907 edition of the Code. A subcommittee appointed to consider the subject of electric smoothing irons recommended that the entire matter be referred to the Underwriters' Laboratories, where tests should be made with a view to formulating rules regulating the installation and use of this device. The subject of grounding low-potential circuits is to be reopened, a committee for this purpose having been appointed to confer with committees from the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies and the National Electric Inspectors' Association.

Slight changes were made in the rules governing the installation of signaling systems, and also in the rules governing the insulation of slow-burning weatherproof wire. After exhaustive tests on both panel and cross-seat types of street car heaters, it was deemed unwise to make any changes in the rules already in force; but cut-outs and switches in car houses must be placed between the non-grounded side and the lamps or motors they are to protect. Moreover, all rails must be bonded with a conductor equivalent to No. 00 B. & S. gauge. In car houses all pendant cords and all portable conductors are considered to be subject to hard usage, and hence must have an extra layer of rubber between the outer cover and flexible cord and have a tough, braided cover over the whole.

The rules governing the installation of double and single pole switches were modified so that single-pole switches may be installed, where, under the rules, no switch would be required. These changes do not modify the rules pertaining to switches for services or for motors and heating devices.

Rules and explanatory notes were adopted for use by the laboratories, calling for two ratings of variable-speed alternating-current motors; one, the maximum current the motor will carry for five minutes, and the other, the maximum current the motor will carry for 30 minutes, starting cold. From these ratings the safe allowable current for any length of time between these can be determined by interpolation.

A complete set of special rules governing the installation of wires and apparatus for electric light, heat and power in theaters was adopted. Rules for moving picture machines were also formulated, and these will replace those already in the Code. The rules governing the installation of resistance boxes and equalizers were amended, and a new section added prohibiting the starting of variable speed motors, unless of special design, under weakened field, if they are controlled by field regulation.

The proposition that rheostats be constructed so that even if the resistive conductor be fused by excessive current, the arc or any attendant flame will be quickly and safely extinguished, met with some opposition and much discussion. It was finally given into the hands of a committee, who are to consult with manufacturers and frame reasonable rules governing the manufacture and installation of certain rheostats, especially those of the grid type. This committee will take up other details of manufacture than the resistive material and also report on the question of circuit breakers and fuses in connection with motor-starting boxes, upon which no satisfactory rules exist.

The rule prohibiting the use of incandescent lamps in series for decorative purposes inside of buildings, except by permission, was stricken from the Code. New rules governing the installation of metal molding were adopted. In metal molding the use of approved conduit wire is made mandatory. With this system it is recommended that for direct-current circuits the two or more wires of a circuit be placed in the same molding so that a subsequent change to alternating current may be easily made, if this be found desirable.

Fine print notes were added to the general rules covering the installation of fuses, providing that the fuse in the neutral wire of three-wire systems may be omitted, provided that the neutral wire is of equal carrying capacity to the larger of the outside wires and is grounded as provided in the Code.

Rules governing the construction and equipment of electric signs were adopted for laboratory use and will be printed in the "List of Fittings." These rules cover the electric sign manufacture very fully from a fire hazard standpoint and give a definiteness to the question of whether the sign meets the Code requirements or not. Heretofore there were as many opinions as there were inspectors.

The proposal to eliminate wooden molding from show windows was voted down by a large majority.

Following are some of the more important changes made to the Code not already covered in committee reports:

The use of an enclosed-type motor is recommended in dusty places, being preferable to wooden boxes.

In central or sub-stations, casings of transformers, other than thoroughly insulated instrument transformers, must be permanently and effectively grounded.

Sub-bases of porcelain or hardwood which will separate the

wires at least ⅜-in. from the surface wired over, must be installed under all snap switches used in exposed and molding work.

Key sockets will not be approved if installed over specially inflammable stuff, or where exposed to flyings of combustible material.

Flexible cord must not be used in show windows, except when provided with an approved metal armor, and for portable use may have an approved metal flexible armor instead of the outer covering required by the Code.

Snap switches must operate successfully at 50 per cent overload in amperes and at 125 volts direct-current, for all switches of 125 volts or less, and at 250 volts direct-current, for all 126 to 250-volt switches under the most severe conditions which they are liable to meet in practice.

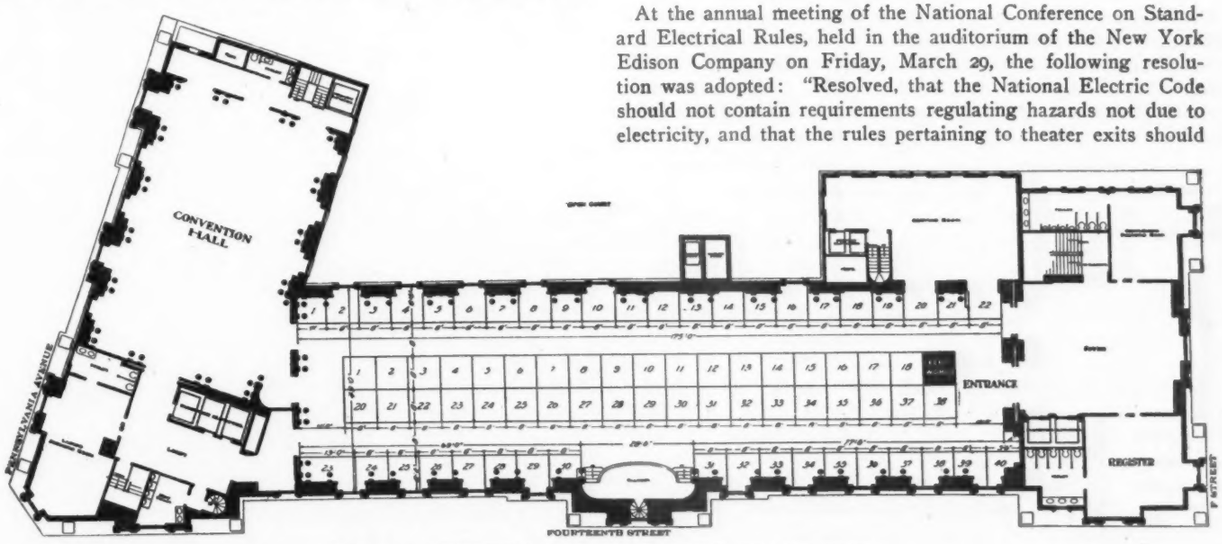
All sockets must be marked with the manufacturer's name or trademark. The standard key socket must also be plainly marked, as, for example, 250 V. 50-cp. Keyless sockets and special sockets must be marked with the current and voltage for which they are designed.

The inside of the shell of sockets must be lined with insulating material which must absolutely prevent the shell from becoming a part of the circuit, even though the wires inside the socket should become loosened or detached from their position under the binding screws.

Bottoms of cabinets should have a slant to prevent the accumulation of dust and also to prevent their being used as shelves.

Washington National Electric Light Convention.

The accompanying cut is a plan of the floor in the New Willard Hotel, Washington, D. C., which has been taken by the National Electric Light Association for the period of its Washington convention, to be held June 4, 5, 6 and 7. The secretary's headquarters will adjoin the elevator lobby, and the headquarters of this journal is near by. The master of transportation will have a room adjoining that of the secretary. The sessions will be held in the small ballroom on this floor, which has ample seating capacity, and being located on the highest floor, is well open to light and air.



N. E. L. A. CONVENTION FLOOR PLAN AT NEW WILLARD HOTEL.

Rooms in the New Willard or any other hotel selected by a member will be reserved upon application to Mr. Dudley Farrand, secretary of the General Convention Committee, 55 Duane Street, New York.

The master of transportation, Mr. George F. Porter, is now arranging for special railroad rates from different parts of the country. If a sufficient number can be secured from the large centers, arrangements can probably be made for special cars from those points. Details as to transportation will be published later.

Following the plan of last year, arrangements are being made for an exhibition by associate members. For this purpose the large ballroom of the New Willard, having a floor area of approximately 10,000 sq. ft., has been secured. This room is on the same floor with the hall in which the meetings will take place and ample elevator service at both ends insures to each section about equal value from the standpoint of attendance and display. A departure from last year's practice will be made in the renting of sections, in that the price will include the erection of booths, wiring and lighting. This will eliminate the annoyance incidental to contracting separately for each item. The prices have been fixed at $100 for wall sections, and $125 for center sections.

Information relating to details of the exhibition may be obtained from the vice-chairman of the exhibition committee, Mr. Walter Neumuller, 55 Duane Street, New York City.

It is expected that the rental to be derived from exhibits will not much more than pay the expenses in connection therewith. The plan inaugurated by the association last year of meeting the expenses of the convention, rather than allow the local company to assume such burden, will be followed this year, and convention expenses will be met by individual company subscriptions. These may be sent to the treasurer of the association, Mr. W. C. L. Eglin, who has kindly consented to serve as treasurer of the convention. All subscriptions for the convention will be applied solely to that purpose and, subject to the action of the executive session, any surplus will be returned pro-rata to the individual subscribers.

Meeting of the National Conference on Standard Electrical Rules.

At the annual meeting of the National Conference on Standard Electrical Rules, held in the auditorium of the New York Edison Company on Friday, March 29, the following resolution was adopted: "Resolved, that the National Electric Code should not contain requirements regulating hazards not due to electricity, and that the rules pertaining to theater exits should come under this class." This had reference to a rule passed the day previous by the Underwriters specifying that all theater exits should be plainly marked by a sign at each, the face to be illuminated and bear the word "exit," the letters of which must not be less than 4 ins. high, and also stating that there must not be more than one set of fuses in any "exit" sign circuit between service fuses and sign. Representatives of the various national organizations comprising the National Conference were in attendance, and many points in the Code were explained by the representative of the Underwriters present. Mr. W. H. Blood, Jr., is president of the Conference and Mr. C. J. H. Woodbury, secretary-treasurer.

United States Government Coal Specifications.

Some years ago the United States Treasury Department, at the suggestion of Mr. J. E. Woodwell, inspector of electric light plants, put into effect a system of purchasing coal upon the heat unit basis for the electric plants under its charge, the quality of the coal under such a contract being determined by proximate analysis and calorimetric tests. Since the work was first started the method has been developed, step by step, as the result of experience in its use in the department and also by studying similar methods employed by the Interborough Rapid Transit Company, of New York, the Fuel Engineering Company, of Chicago, the United Gas Improvement Company, of Philadelphia, and other corporations which buy large amounts of coal. The success of the system has been so marked that this year Congress authorized the Fuel Testing Division of the Geological Survey to determine the quality of coal purchased by all Government departments, the expense being borne by the general appropriation for fuel testing. It was accordingly considered opportune to prepare a general specification for all coal offered for Government use, except certain purchases made for the navy. A standard specification was developed by the joint efforts of Messrs. J. E. Woodwell, E. D. Randall, of the Geological Survey, and Mr. S. S. Voorhees, engineer of tests, Treasury Department. The preliminary draft of this specification was submitted to the Advisory Board on Testing Materials, appointed by President Roosevelt some time ago, and this board modified the arrangement of the specifications somewhat. It seems likely that at least a half of the departments of the Government will adopt the specifications during the coming fiscal year. The tests are believed to be fair to both purchaser and seller of coal, and many coal dealers have already signified their willingness to furnish fuel on this basis, and have commended the method. Nevertheless, discussion of the specifications is invited and, if offered, will meet with careful consideration.

The specifications open with a description of the desired fuel for the contract in hand, inserted by the Government representative, based on a consideration of the boiler and furnace condition under which the fuel will be used. It is not expected that all deliveries will be absolutely uniform or agree exactly with the standard established by the contractor in his tender under the specification, but it is necessary for all deliveries to be within the limit set by the Government. These limits are considered wide enough to permit the use of the output of any mine or group of mines, provided proper care is exercised in mining and in picking out refuse. Bearing these facts in mind it is only necessary for the bidder to select coal for each proposal which will meet the description given in the specifications for that particular lot, and permit deliveries within the time limit set. Of course, the standard established by the contractor should be one which requires the least correction for variation in heat units and ash from the values set up.

In all practicable cases the coal will be sampled at the time it is being delivered into the building where it will be used. The sample taken will in no case be less than 100 lbs., selected proportionally from lumps and fine coal. It will be pulverized as rapidly as possible until none of the fragments exceed ½-in. in diameter, and will then be quartered until the final sample can be contained in the shipping can or jar, which will be sealed air-tight and sent to the Treasury Department for analysis. Immediately on receipt of the sample it will be analyzed according to the method adopted by the American Chemical Society.

Coal containing percentages of volatile matter, sulphur and dust higher than the limits indicated in the specifications and coal containing a percentage of ash in excess of the maximum limit indicated in a table forming part of the specifications will be rejected. Occasionally deliveries containing ash up to the percentage indicated in the column of "Maximum Limits for Ash" in the table, may be accepted. Frequent or continued failure to maintain the standard established by the contractor, the bid, will be considered sufficient cause for the cancellation of the contract. Payment will be made on the basis of the price named in the proposal for the coal specified by the bidder, corrected for variation in heating value and ash, as shown by analysis, above and below the standard established by the bid. For example, if the coal contains 2 per cent, more or less, B. t. u. than the established standard, the price will be increased or decreased 2 per cent, accordingly. The price will also be further corrected for the percentages of ash. For all coal which by analysis contains less ash than that established in the proposal of the bidder a premium of 1 cent per ton for each whole per cent less ash will be paid. An increase in the ash content of 2 per cent over the standard established by the contractor will be tolerated without exacting a penalty for such excess. When the excess exceeds 2 per cent above the standard established, deduction will be made from the price in accordance with a scale included in the specifications.

The heating value expressed in B. t. u. of coal containing approximately the same percentage of ash is essentially a direct measure of the actual value to the purchaser, and for this reason the specification provides for an adjustment of payment in direct proportion to the variation in heat units in the coal as received. As the coal is weighed when delivered and the payments are based also upon the price per ton, it is necessary to determine the heating value of the coal in the condition in which it is received, containing whatever moisture may be present at the time. The correction in payment made for the variation of ash in dry coal is to take account of the cost of handling additional fuel and ash and its effect on the capacity of the boiler and furnace.

Lightning Phenomena and Lightning Arresters.

The regular March meeting of the American Institute of Electrical Engineers, held March 29, 1907, was devoted to lightning phenomena and the protection against lightning. Lightning phenomena in electric circuits was discussed by Dr. C. P. Steinmetz. Protection against lightning and the multi-gap lightning arrester were treated in a paper by Messrs. D. B. Rushmore and D. Dubois; while Prof. E. E. F. Creighton described some new principles in the design of lightning arresters.

Dr. Steinmetz stated that the term "lightning," as applied to the phenomena in electric circuits, denotes all abnormal voltages and abnormal frequencies. The phenomena comprise the internal disturbances due to defects of the circuit or its operation, external disturbances due to atmospheric electricity, and surges which may be brought about by the external or internal disturbances and depend for their energy on the generator systems. The mean potential difference between an electric circuit and the ground may gradually rise on account of the accumulation of an electric charge in the circuit. The charge may sometimes be attributed to direct contact with rain, snowdrift or fog carried by the wind across the line. It is sometimes produced by electrostatic induction from a passing cloud. Thus, when a positively charged cloud passes over a transmission line, the ground below the line possesses a negative electrostatic charge. If the line is insulated from the ground it assumes a positive potential against the ground, and when the potential difference increases to a sufficient value a discharge takes place. The danger from the accumulation of charges lies in their liability to damage the insulation of the system by punctures and to produce by their discharge other and more serious disturbances.

A second class of lightning phenomena is found in the impulse of traveling waves. A sudden charging of a transmission line, as by a lightning stroke or by any other sudden local change, produces a wave of potential and of current which runs along the line. Such a wave is very high and has a steep front at its starting point, but it gradually broadens and flattens out and ultimately disappears if the line is of unlimited length. When such a wave reaches the end of the line it is reflected and thrown back, thereby forming a system of nodes and antinodes and producing a standing wave. When a traveling wave reaches a station it is partly reflected by inductance of reactive coils,

transformers, instruments, etc., and is partly transmitted. The different reflected and transmitted waves become superposed upon each other, and the impulse is broken up into a number of secondary impulses and local standing waves, which may reach voltages far higher than that of the traveling wave. Some of the causes of such traveling waves are direct or secondary lightning strokes; electrostatic induction by the clouds; discharges of slowly accumulated potential; any spark discharge from one line to another or to the ground; the existence of a self-rupturing arc in the system, or any sudden changes of load connection or disconnection of apparatus.

Standing waves or oscillations in electric circuits vary from the very low frequency of the fundamental surge of very long transmission lines, which produces commercial alternating current frequencies to frequencies of several hundred million cycles per second, as found in the discharge oscillation between cylinders of a multi-gap lightning arrester. Due to this enormous range of frequency the physical effect of the oscillation also varies greatly. When discharging a high frequency oscillation, lightning arresters may fail to hold back the machine current and the short circuit resulting therefrom may produce a low frequency surge.

As introductory to their discussion of the protection against lightning, Messrs. Rushmore and Dubois exhibited a large number of photographs of lightning showing the varieties of discharges which may be expected. They stated that from the standpoint of protection of the system from static disturbances whether external or internal, the grounded star transformer connection with overhead ground wire offers the best conditions and is in general to be recommended where the choice is not determined by other conditions. Due to its apparent simplicity, the horn lightning arrester has of late received considerable attention. It is, in reality, an emergency device and serves as a weak point in the system which is the first to rupture when the voltage increases to a dangerous value. In general, the discharge of horn arresters without resistance will throw synchronous apparatus out of step, and necessitates starting up the system again. A flaming arc in air, such as occurs on the horn arrester discharges, is a possible source of disturbance much worse than the original one and under certain conditions it can give rise to very high voltages, so that the possibility exists that the horn arrester instead of being a protective feature may become a disturbing one.

A considerable portion of the paper by Messrs. Rushmore and Dubois was devoted to the multi-gap lightning arrester. As is well known, the essential elements of this arrester consist in a number of cylinders between line and ground and line and line, small air-gaps being left between the cylinders. The advantageous characteristics of the arrester are to be attributed to the electrostatic capacity between the individual cylinders and between each cylinder and the ground. When voltage is impressed across the arrester the potential gradient is not uniform along the cylinders because the charging current which passes between the adjacent cylinders depends not only upon the electrostatic capacity between the cylinders, but also upon the capacity to ground. Thus the potential gradient is considerably steeper at the high voltage end of the arrester. At a certain voltage across the arrester the potential gradient between the first and second cylinders is sufficient to break down the dielectric between them; the potential of the second cylinder being connected to the first by an arc, then rises and a breakdown occurs to the third cylinder and so on until the arc has passed entirely across the arrester. The line current then flows across and the potential is distributed uniformly along the cylinders; the maximum potential difference is less than in the case of the initial breakdown, so that the arc may become ruptured.

As stated above, when the breakdown occurs from the first to the second cylinders, the potential of the second cylinder depends upon the amount of current which passes. As this current is that due to the capacities it will be greater at higher frequencies. The multi-gap arrester will, therefore, discharge more easily at high frequencies than at low. By properly designing the resistance used in series with the arrester, the arrester can be made to protect equally as well at one frequency as at another. The resistance is one of the most important factors in lightning arrester construction. Its usual functions are in general to limit the current and to give fewer gaps for the low frequency discharge to break across. In the new designs the discrimination with regard to the higher frequency has been largely removed by the use of three resistances designated, respectively, as the low, the medium and the high, shunted across certain numbers of the cylinders. The arresters are so designed that should the arc pass across all of the gaps following the static discharge, the number of gaps is sufficient to extinguish the arc. The cylinders are arranged in four groups. Across the first group is shunted the low resistance; across the first and second combined is shunted the medium resistance; across the first, second and third combined is shunted the high resistance, while no shunt is placed around the fourth group. The extremely high frequency discharges break across the cylinders in rotation. It has been found that when the gaps are shunted by a resistance of sufficiently low value the current from the dynamo will not follow the high-frequency across the gaps, but will be shunted at once to the resistance and the arc will thereby be extinguished.

The paper by Prof. Creighton described a new form of liquid electrode lightning arrester. Two metallic electrodes extend into a vessel containing an electrolyte of high conductivity. The electrodes may be dipped into the electrolyte or there may be a small gap left between the electrode and the electrolyte. When current is passed from one electrode to the other in either direction the liquid must become negative at one or the other electrode. Due to the so-called counter-electromotive force of the arc it requires about 1500 volts to maintain the current through the cell, in spite of the fact that the resistance of the cell is extremely low. At any e. m. f. above 1500 volts per cell there is produced a rush of current in proportion to the pressure above 1500 volts. In other words, there is a critical voltage above which a free discharge of electricity passes without the intervention of anything more than a slight ohmic resistance. With an alternating voltage a spark can form into an arc only at peak value and it is extinguished before the voltage reaches zero. When the metallic electrodes touch the liquid it is necessary to introduce a single air-gap in series. The series gaps may be set at any value above that corresponding to the line potential. When a discharge occurs across the gaps the current flows at a short-circuit rate. The current density at the electrode is such as to start an arc, which throws the electrolyte away from the electrode and automatically lengthens the arc. The arc voltage being greater than the impressed voltage, the current dies out before a complete cycle; the series gap is sufficient to withstand the line voltage, and the electrolyte assumes again its level in contact with the electrodes. Extensive experimental tests have been made with the liquid electrode arresters on 2300-volt, 13,000-volt and 33,000-volt circuits.

The discussion was opened by Dr. F. A. C. Perrine, who disagreed with the presentation of the case of the horn arrester. The proper use for this arrester is as an extra protection against surges which would probably destroy any other type of arrester and leave the apparatus without protection during the continuance of the storm. Experience has shown that where horn arresters are used in parallel with multi-gap arresters the high frequency disturbances discharge harmlessly over the multi-gap arresters; while the low periodicity surges pass over the horn arresters. He stated, as his opinion, that in the present state of the art, leaving out of consideration the recently described electrolytic arrester, the best protection is found in a combination of the horn and multi-gap arresters. In the electrolytic arrester there is found a new type of protective apparatus. The formation of an actual arc in the electrolyte seems very important, indeed, to its proper performance. The electrolyte arrester seems to be objectionable in that the arc formed within the arrester would probably rapidly evaporate the electrolyte, and the cells would require considerable watching.

Mr. Farley Osgood related some actual experiences with 60 miles of 30,000-volt transmission circuits feeding power to three

sub-stations, in which 60-cycle rotary converters are used. Resistances in series with the gaps of multi-gap arresters were tried, but discarded, and subsequently resistances were placed in shunt with the gaps. The record for 1906 shows that there has been no interruption to service, although 20 discharges have been noted.

Mr. P. H. Thomas stated that the multi-gap arrester with shunt resistance, leaving out of account the electrolytic arrester for the present, seems to be the most promising protective device now available. He expressed the opinion that the art of protection against lightning is now so far advanced that it is unnecessary to be annoyed by the shutting down of the plant, such as is occasioned when a horn arrester discharges.

Mr. V. G. Converse called attention to the fact that when fuses are used in series with the horn arrester, a single stroke does not leave the system unprotected, because it is possible to employ repeating fuses so arranged that when one fuse blows a switch drops and connects in a second fuse, a third fuse, a fourth fuse, and so on. The Ontario Power Company during the whole of last season observed only one discharge from the generators at the power station, but there were numerous discharges from the lines across the insulators. Experience has shown that a lightning disturbance seldom travels more than four or five line spans before it will pass to ground by way of a tower.

Mr. D. Dubois explained that multi-gap arresters are so designed that when a discharge occurs the current from the generator is limited by the higher series resistance to about one-sixteenth of an ampere, which causes such a drop in the resistance rod that there remains a drop of only about 80 volts across each gap. This voltage is so low that the arc is promptly ruptured.

Mr. William McClellan reported the results of some observations made upon multi-gap lightning arrester equipments used on 11,000-volt trolley circuits, which tended to show that such arresters are destroyed when the disturbances are heavy and frequent. The electrolytic arrester possesses most excellent characteristics in that it acts exactly like a safety valve. When the station supplying the power is equipped with large generator capacity, so that a short-circuit sustained for a considerable time will not cause a shut-down, horn arresters can be used to advantage When extra insulation is placed on the end turns of transformer windings and powerful insulators are used on the line a certain rise in voltage may be taken care of without protective devices. The lightning arresters should be so adjusted as to relieve the line from any excess voltage but not to discharge every time the voltage rises slightly above the normal.

Mr. Ray P. Jackson explained that in the type of electrolytic arrester used by him there seems to exist a dielectric film, which after it has been punctured is capable of resealing itself when the voltage drops below a certain value. It acts like a valve with a spring behind it. Concerning the horn arrester, it may be stated that its virtues consist chiefly in its mechanical characteristics. It is comparatively simple and cheap, and can be placed out of doors. It will prove an excellent device for use in series with an electrolytic arrester for limiting the current from the dynamos to a small value.

Mr. H. C. Wirt remarked that the only disadvantage possessed by the electrolytic arrester resides in the liquid. It seems, however, to represent the solution of the lightning arrester problem. He submitted some data regarding the operation of the shunt resistance type of multi-gap arrester on a 33,000-volt system installed at Joplin, Mo. Although much trouble was experienced with the series-resistance type of arrester, almost perfect results have been obtained with the shunt resistance arrester subsequently used.

Dr. C. P. Steinmetz, in replying to the objections raised against the employment of a fuse in a shunted resistance arrester, stated that when the fuse blows the system remains protected equally as much as though the fuse had initially not been installed. The conditions are in no respect analogous to those existing when a fuse is inserted in series with the horn type of arrester.

CURRENT NEWS AND NOTES.

MAGNETIC CLUB ANNIVERSARY.—The Magnetic Club of New York will celebrate its nineteenth anniversary and its spring meeting with a dinner at the St. Denis Hotel on Wednesday, April 17, at 6:30. A most delightful time is expected, and in addition to the excellent dinner a unique programme of entertainment has been provided. Mr. George H. Usher is president, and Mr. T. E. Fleming is chairman of the entertainment committee.

A. I. E. E. NOMINATIONS.—The Board of Directors of the American Institute of Electrical Engineers has selected the following nominees for the forthcoming annual election: President, Mr. Henry G. Stott, New York; vice-presidents, Messrs. L. A. Ferguson, Chicago, W. C. L. Eglin, Philadelphia, J. G. White, New York; managers, Messrs. Percy H. Thomas, New York, B. G. Lamme, Pittsburg, H. W. Buck, New York, Morgan Brooks, Urbana, Ill.; treasurer, George A. Hamilton, New York; secretary, Ralph W. Pope, New York. The following were transferred from the grade of associate to full member: Prof. A. S. Langsdorf, St. Louis, and Mr. L. L. Perry, New York.

STREET LIGHTING SPECIFICATIONS.—A meeting of the committee of the National Electric Light Association to consider street lighting specifications and new methods for street illumination was held on Saturday, March 30, at the offices of the association in the Engineering Societies' Building. Mr. Dudley Farrand is chairman of the committee, and the other members are Messrs. Louis A. Ferguson, Paul Spencer, C. P. Steinmentz and A. E. Kennelly, all of whom were present. It is the intention of the committee to frame a model contract between municipalities and central station companies doing street lighting, and to include therein the relative illuminating values of the several types of illuminants now in use for such purpose, so that if a company wishes to change over from one system to another there may be no difficulty in settling the question of relative efficiencies. This is a subject regarding which many inquiries have been directed to the office of the association, and the report of the committee will be greatly appreciated by the members and the general public.

TELEGRAPH RATES have been advanced from April 1 by the Western Union and Postal Telegraph Companies, the increases ranging from 33 to 66 per cent. Several States which escape the increase for the present are California, Florida, Idaho, Indian Territory, Louisiana, Michigan, Nevada, Oregon, South Dakota, Texas, Utah, Washington State, Wisconsin and Wyoming. In Canada, the Provinces of Manitoba, Ontario and Quebec are exempt from the increase. In explaining the advance, President Clowry is quoted as follows: "It is simply a readjustment of the rates, one that the company has had in mind for some time. It was made necessary by the fact that the Western Union has been losing money on many of its messages for several years. This state of affairs was brought about some time ago by a war between the independent telegraph companies. During this war the price of messages in some districts was cut down so low that, instead of a profit, there was a loss in handling them. The companies in that war were bankrupted, naturally enough. Some of the rates that were made as a result of that war have remained the same ever since. We have been losing money on a great many 25-cent messages. Such messages have been costing us in many instances from 28 to 30 cents to handle. Another thing that has influenced the company to increase the rate in certain localities is the great increase in the cost of running the business. For instance, copper wire now costs twice as much as it did a few years ago. The increase in cost of telegraph material has been from 25 to 100 per cent. The general cost of maintenance is greater than formerly. The cost of labor is higher. I wish it distinctly understood that this is not a general increase, but merely a readjustment of the old rates."

HUNGARIAN TELEGRAPHS.—U. S. Consul-General Chester reports from Budapest that postal, telegraph and telephone rates will not be raised in Hungary, but that the Hungarian Minister of Commerce will make every effort to make arrangements to lower the rates.

PHILADELPHIA COMMISSION.—The Gas Commissioners of Philadelphia, in a report to the City Council, have recommended the appointment of a board of gas and electric light inspection, of three members, to be named by the Governor, not connected in any way with local lighting interests.

SAN FRANCISCO IN DARKNESS.—A dispatch from San Francisco, dated April 2, states that the main power house of the San Francisco Gas & Electric Company, in South San Francisco, was destroyed by fire that evening and that the city was left in darkness. The cause of the fire is not known, but it is thought it started in the engine room. The electric railways continue in operation, as they get their power from other sources. The loss is stated to be $1,000,000.

ALUMINUM-COBALT ALLOY AS A SUBSTITUTE FOR COPPER.—An alloy of aluminum and cobalt is claimed by the inventor, William C. Davis, of Readsboro, Vt., to possess properties that will cause it to supersede copper for electrical purposes. It is claimed that the alloy can be sold for 18 cents per pound. Tests made at the Stanley works in Pittsfield, Mass., gave a specific resistance 18.8 per cent less than that of copper and a specific gravity 14.2 per cent less. The tensile strength is stated to be as 71.8 to 63.31 for copper.

UNDERWRITERS' RULES.—In an address delivered before the New York Electrical Society on March 27, Dr. C. J. H. Woodbury outlined the development of the National Electrical Code from the year 1885, when the first rules were formulated, until the present time. He stated that in almost every case the enforcement of the rule had caused the price of the apparatus to be increased, but both the maker and the user had subsequently profited by reason of the changes. Much information was given concerning the intimate connection between improvements in telephone equipments and the ability to decrease the damage done by fire by reason of instantaneous alarm systems. As an illustration of the present excellence of telephone work, lantern slides were shown of masses of telephone wires and high-tension electrical circuits closely intermingled by storms without any damage whatsoever being caused to the telephone switchboard apparatus.

COLORADO SPRINGS LAMPS.—In our issue of February 23 an account was given of the controversy then being arbitrated between the city of Colorado Springs and the Pike's Peak Hydro-Electric Company as to the proper candle-power rating of arc lamps. Eminent experts appeared before the arbitrators, Messrs. L. G. Carpenter, E. L. Elliott and Henry Floy, and considerable testimony was taken on the complicated points at issue. The total claim of the city for alleged inadequate and improper service was for several thousand dollars and the arbitrators, as we go to press, have filed an award in favor of the city of $7,123.67. The decision, under five different heads, discusses the technical points involved as to meaning of "2000-cp lamps," the actual service given and the amount of overcharge involved. The arbitrators hold that there was no intention on either side to evade the obligations of the contract. We shall return to this subject next week, when the full text of the decision is before us.

THE CHICAGO ELECTION for Mayor, on April 2, resulted in a decisive victory for Mr. F. A. Busse, the Republican candidate, now postmaster of the city. The defeated candidate, Mayor E. F. Dunne, is the representative of municipal ownership, and tried to block the traction ordinances intended to give the city a modern trolley system with the aid of private capital. The Republican party favored ordinances which were recently passed by a Democratic City Council over the veto of Mayor Dunne. These ordinances provided for 20-year franchises for the street car companies, the city retaining the right to purchase the system for $50,000,000 plus the amount to be spent for immediate rehabilitation of the lines, six months' notice being necessary of the city's intention to acquire the property. The ordinances also provide for universal transfers throughout the city, a 5-cent fare and 55 per cent of the net profits of the companies to be paid to the city. The vote generally showed a decided reversal of public opinion on municipal ownership, compared with the Mayoralty campaign two years ago. Mr. Dunne was supported by the "yellow" Hearst newspapers, but by no others, all the decent organs of public opinion being strongly against the Dunne programme.

P. R. R. SCHOLARSHIPS.—At Philadelphia on March 27, the offer of Anne Thomson, Frank Graham Thomson, and Clark Thomson, of a fund of $120,000 to establish what are to be known as the "Frank Thomson Scholarships," was accepted and approved. The fund has been deposited with the Fidelity Trust Company, as trustee. The grantors of the trust declare their desire to afford to "sons of living or deceased employees of all the lines of the railroad an opportunity for a technical education, so as better to enable them to qualify themselves for employment by the company." Competitive examinations are to be held, open only to sons of Pennsylvania employees, "corresponding in general to the entrance requirements of the scientific departments of the higher class universities, colleges, and technical schools." The company, in selecting candidates is allowed to take into consideration not only the examination "marks" but the physical and moral qualifications requisite for railroad employees. After passing the examinations held by the company, the winner of a scholarship must qualify for admission to one of the technical schools or departments approved by the company before he receives his certificate entitling him to draw upon the scholarship fund. Beginning this year two scholarships, each of which amounts to $600 a year, are to be filled, and every year two will be added. After four years two will be graduated annually, keeping a total of eight men in college all the time.

THE PUBLIC UTILITIES BILL now proposed in New York State was the subject of severe attack by prominent corporation counsel at a hearing at Albany last week before the joint Assembly Railroads and Senate Judiciary Committees. The principal amendments asked for by the various critics are: A judicial review of all actions of the proposed public service commissions, both as to facts which may be in dispute and as to the law involved. The appointment of high-class men at a larger salary than that proposed in the measure. The independence of the commissions of the political powers to be insured by taking from the governor the power of absolute dismissal. Omission of the clause in the present bill that would prohibit traction companies from acquiring the stock of other traction corporations to the extent that would render a merger possible. Omission of that portion which would give the proposed commissions absolute control in the matter of capitalization and stock issues by public service corporations. A general toning down of those portions of the proposed law dealing with the financial supervision of the traction companies, as well as with the supervision of their operating methods, schedules, and rates. There were also general and sweeping objections based upon the ground that the proposed public service law was far more stringent than the Inter-State Commerce act, but the representatives of the traction and steam railroad interests also registered their objections against sections of the bill that had been copied from that act, on the ground that there was no reason for a re-enactment. Mayor McClellan sent a message in opposition to the bill, based upon the principle of home rule and local appointment of the proposed five commissioners for Greater New York.

NEW YORK ELECTRICAL SOCIETY.—At the meeting of this useful body, held last week, 51 new members were elected. The society now has a total active membership of 755, the largest recorded since its organization in 1881. The officers propose to make this 1,000 at an early date.

ILLUMINATING ENGINEERING SOCIETY.—The next meeting of the New York Section of the Illuminating Engineering society will be held Friday, April 12, at 8:15 p. m., at the Edison Auditorium, 44 West Twenty-Seventh Street. The subjects for discussion will be as follows: 1. Standards of light, primary and secondary. 2. Comparative rating of inverted and upright incandescent gas lamps. 3. Desirability of combining different illuminants and lights of different color in stores. 4. Modifying effect exercised by reflectors and globes upon the distribution of light about a source.

WORCESTER BRANCH A. I. E. E.—Dr. George R. Olshausen, of Cornell University, addressed the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers, at the Institute, on March 25, his subject being "The Power Plant of the Omaha and Council Bluffs Street Railway Company." The lecture was attended by nearly every member of the branch and by many students from the electrical department not members. It was illustrated by stereopticon views. The address was given an added interest by the fact that Dr. Olshausen was the engineer of construction.

OUR NATIONAL WEALTH.—The total estimated valuation of the national wealth in 1904 was $107,104,192,410, according to a special report just issued by the Census Bureau on wealth, debt and taxation, which represents an increase in the four-year period from 1900 to 1904 of $18,586,885,635. This advance has no parallel in the history of the United States, except in the decade from 1850 to 1860. In 1850, when the first estimates of the national wealth were made, the figures were only $7,135,780,228. The most potent cause for the increase from 1900 to 1904, it is stated, was the reaction from the low prices of the period of depression from 1893 to 1896. The annual increase of wealth per family from 1890 to 1904 was $182. The figures for 1904 include $2,219,000,000 for street railways, $227,000,000 for telegraph systems, $585,000,000 for telephone systems, and $562,000,000 for privately owned light and power plants. The steam railroad systems of the country are set down for $11,244,000,000.

TECHNICAL PUBLICITY ASSOCIATION.—The subject of "house organs" for manufacturing concerns was discussed at the regular monthly meeting and dinner of the Technical Publicity Association, held Thursday evening, March 28. Addresses were made by Stuart Benson, R. Wallace & Sons Mfg. Company; David Gibson, Globe Machine and Stamping Company; Henry M. Cleaver, Niles-Bement-Pond Company; H. L. Myers, New York Leather Belting Company, and W. G. Snow, Meriden Britannia Company. Each one of the speakers is the editor of a successful publication published in the interests of the company he represents. In some cases the house organ has taken the place of advertising in the trade press; and in other cases space in the trade magazines has been used as before, or merely to exploit the "house organ." Ten new members were elected. The next session will be the closed annual meeting, April 18, 1907, at the rooms of the Aldine Association, at which officers for the ensuing year will be elected.

TAXAMETER CABS FOR NEW YORK.—It is stated that the New York Transportation Company will put out about two hundred of them within the next six months. According to President Meade, the company will also gradually put on a series of gasoline cabs which are more comfortable than those now used for city travel. The gasoline cabs will also be supplied with the taxameters. "We are going to adopt the taxameter because we think that not only can we give our customers better satisfaction, but that we can make more money ourselves," said Mr. Meade. "Its success has been demonstrated in several European cities. Some of the cab drivers don't like the idea of having the new machine, but abroad it has been found that the very men who exhibit the greatest dislike to it at first are the ones who afterward like it the best. It is a genuine help to the driver or chauffeur, as it insures that passengers will only be charged what they are legally supposed to pay, and thus will give the public confidence in public cabs. While our profits with taxameter cabs on the separate runs will not be as great as now, we shall more than make up the difference in the increased use of cabs."

U. S. MILITARY TELEGRAPHERS.—The U. S. Military Telegraph Corps gave a dinner last week at the Hotel Manhattan, New York, to Mr. Andrew Carnegie, as the man who suggested at the outset of the Civil War the formation of that useful and patriotic body. Of the 1500 once in the corps, in the field, or at the front, or in Washington, about 200 survive, and it is proposed to form a memorial organization. Chairman David Homer Bates, one of the four operators dispatched to the front at the first call in the Civil War, was in the chair, and read, as he introduced Mr. Carnegie, the historic telegram he sent proposing the corps. Mr. Carnegie was warmly cheered as he rose. After a sharp criticism of Wall Street gamblers and their bad effect on industry, he gave some reminiscences of his Civil War experience as a telegraph operator. He was a telegraph operator on the Pennsylvania Railroad when the war broke out and there was a call for telegraph volunteers. The menu was couched in simplified spelling.

INDICTED FOR MANSLAUGHTER.—Last week three indictments charging manslaughter in the second degree were handed down by the Grand Jury against the New York Central Railroad Company, as a corporation, and two of its officers, as a result of the investigation of the wreck of the Brewster electric express at Woodlawn on Feb. 16, in which 24 persons were killed and 150 injured. The officials named in the indictments are vice-president and general manager A. H. Smith and Ira A. McCormack, general superintendent of the road. Both of these officers, if found guilty as charged in the indictment, will be liable to fifteen years' imprisonment or a fine of $1,000, or to both, the latter being the maximum penalty for manslaughter in the second degree. As a corporation, however, the railroad cannot be held feloniously, and upon conviction will be liable only to a fine of $5,000. The presentment of the jury finds carelessness in provision and preparation for electric traction, and holds that the motormen of the new locomotives have not been sufficiently trained. The speed of the trains was also too high.

TEST OF METERS.—The annual year book of the Merchants' Association of New York, in the report of President Whitman, has the following: "Various important questions in connection with the supplying of electric light and power have arisen. One of these relates to the conditions under which the electric lighting companies usually supply auxiliary power to firms having their own electric plants. Another concerns the charges of electric light companies, particularly with relation to the quantity of energy charged for and the methods of measuring such quantity. Numerous complaints have been received by the Association as to these measurements. The question is presented as to the accuracy and the sufficiency of the means used by the lighting companies to determine the quantity of energy consumed by individual users. These very important subjects call for full and careful investigation in order that a basis of charge equitable alike to the companies and the consumers may be arrived at, the accuracy of the companies' measurements, upon which consumers are now compelled to rely, may be tested and the sufficiency of their system properly established, and any needed reforms in this respect be brought about. A committee of the Association has this in charge. The subject is a highly technical one which will call for prolonged investigation and expert examination, which it is the intent of the committee to promote."

Electrical Features of the Engineering Societies Building.

During the past year various articles on the Engineering Societies Building on West Thirty-Ninth Street, New York, have been published in these columns, so that readers are, in a way, familiar with the history and general arrangement of this excellent edifice. With the completion of the building, interest naturally centers on its equipment and operating features and, as is to be expected, the electrical features with which we are most concerned are exceptionally good.

As in the case of the other departments of the building, the electrical equipment and the illumination had to fulfill unusual and peculiar requirements, owing to the special purpose for which the building is to be used. In the following description, therefore, the usual features of illumination and of the electrical equipment need but be mentioned, while the unusual and somewhat novel feature will be more fully described.

The electrical supply for the building is obtained from the New York Edison Company and the United Electric Light & Power Company, so that both direct and alternating current are available. Space has been provided, and designs completed so that an isolated electric generating plant may be installed at any time.

The feeders and mains for the lighting system are arranged on the three-wire system, while those for motors are on the two-wire system. In all cases, all of the wires of a given circuit are installed in the same conduit, so as to permit alternating current to be used on any circuit in the building.

As the building is to be used by different societies, it was essential that the feeder system should be arranged so as to provide means for measuring the energy consumption separately in different portions of the building. For this reason, the feeders are sub-divided and the switchboard designed to have meters on each feeder, so as to permit making proper charges for electricity for each floor; separate feeders, of course, being provided for the entrance halls and corridors.

Duplicate feeders from the New York Edison Company are run to the building, so as to afford additional security in case of failure of one of the service mains. Two separate feeders are provided for the lighting of the main auditorium connecting at the switchboard with the two independent service street feeders, thereby providing duplicate and independent lighting service for the main auditorium, so as to preclude, as far as possible, the liability of interruption of the lighting service of the auditorium.

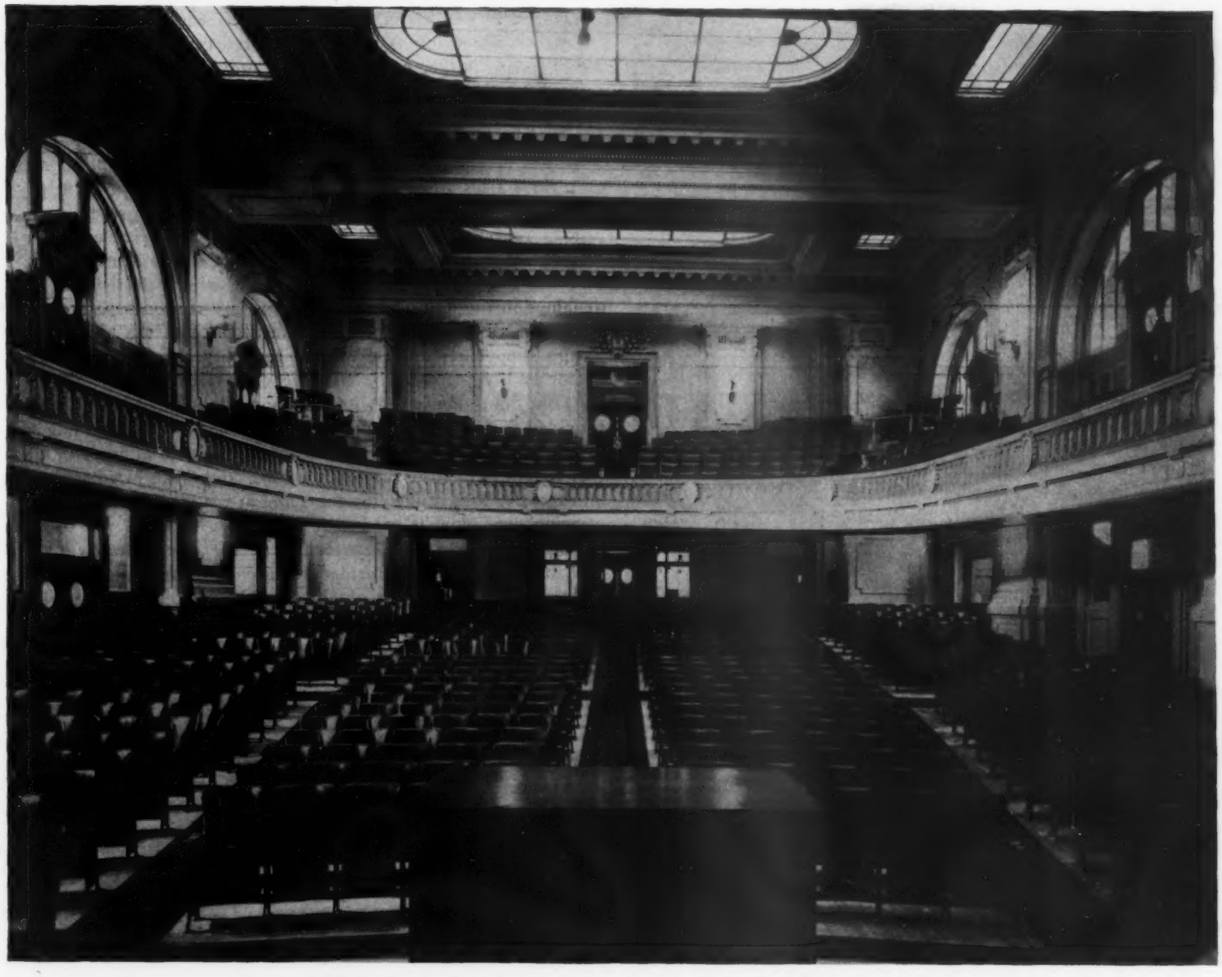


Fig. 1.—Main Auditorium as Seen from the Platform.

By means of the two-hall feeders, it is possible to light one-third, two-thirds or all of the hall and corridor lamps from the switchboard in the basement. In addition, further control is provided by means of switches located in a main cabinet on the first floor, and by local switches at the various cabinets on the upper floors. This flexible and convenient system provides abundant opportunity for reducing to a minimum the energy consumption required for the hall and corridor lighting.

A control switchboard has been provided for the auditorium, in the passageway back of the stage. At this point, the feeders terminate and all of the circuits for the auditorium originate and are controlled. At the upper part of the switchboard, dimmers are provided for the control of the auditorium light-

ing. At this point also, the special feeders and empty conduits for demonstration purposes terminate. Special outlets have been provided on the stage for musicians' lamps, table lamps, etc. Stage pockets are located in the center of the balcony and in the floor of the center aisle of the main floor, for stereopticon or similar purposes.

Cut-out panels are provided in each of the assembly and lecture rooms on the fifth and sixth floors, so as to provide convenient control of the lamps in each room. Special feeders and

FIG. 2.—THE MAIN ENTRANCE.

empty conduits have been provided for demonstration purposes in all of these rooms. Special outlets have been provided in the library for lamps on desks, tables, etc., and special circuit work has been done for lighting the stacks for present and future use.

Inasmuch as it was impossible at the time the building was constructed to plan definitely the arrangement of the various society offices, and consequently, the illumination thereof, it was deemed essential to provide such a flexible system as to permit lamps for desks, etc., to be added as required later. For this purpose a circuit is run to a corner in the ceiling in each room, and from this point a square molding is placed 18 ins. from the wall and symmetrically aligning with the room parallelogram. At any point on this molding a small rosette may be inserted and an attachment for a drop lamp provided.

In order to provide ample electricity for demonstration purposes, lectures, etc., special feeders have been run from the switchboard in the basement to the auditorium, and to each of the assembly and lecture rooms. These feeders consist of six conductors of No. O. B. & S. gauge, installed in 2½-in. conduit. These feeders terminate at special panels in each case, each conductor connecting with a single-pole knife switch and a lug for extending the connections to the lecture room table, machine or appliance, as the case may be. The connections of these feeders at the main switchboard in the basement, are such that any desired combination of the conductors may be made and, if desired, connections for either direct current, or single-phase, two-phase, or three-phase alternating current.

In addition to the special feeders, empty conduits as noted already are run to the auditorium and lecture and assembly rooms, so as to afford raceways for any purpose for which the special feeders would not provide. In the case of the auditorium, two 3-in. conduits run to and terminate in a cabinet at the back of the stage. In the case of the assembly and lecture rooms, a single conduit of 2½ ins. internal diameter has been provided.

A complete and flexible interconnection system has been provided for the building, having its main center in the basement. It affords means for connecting telephones or call circuits in practically every office in the building. In order to avoid running wires around the picture molding or along the baseboards in the offices, the plan was devised by the electrical engineers of having a portion of the base removable, with ample space in the form of a channel extending completely around the room. In order to make this channel continuous, conduits are run under the doors, connecting with the channel space at either side of the door. This channel is connected by means of a conduit, with the nearest interconnection box on the floor.

ILLUMINATION.

Complete specifications were prepared and sketches made by the consulting engineers, acting in co-operation with the architect, for the illumination of every room, and for every fixture in the building. It was realized by the engineers that the illumination was necessarily only one feature of the building and must be subordinate to, and in harmony with, the architectural features.

The central space in the entrance hall or foyer is lighted by means of individual lamps, placed in recesses, and concealed by panes of ground glass in the ceiling, at the sides of the rectangle formed by the columns around the large central area. In addition to this, larger crystal balls are provided in the outer corridor beyond the central space and in the elevator hall, entrances, etc. The object of the individual lamps in the recess, screened by glass, is to afford ample illumination without glare.

Beaded crystal glass balls, holding "metalized filament" lamps of various sizes from 50 to 250 watts, are used on the principal floors, from the first to the fourth, inclusive. In some cases, pagoda reflectors are used inside the balls to increase the effective illumination without increasing the energy consumption. In other instances, however, in order to sub-divide the number of lamps in the hall fixtures, the lamps are run on separate circuits. In all such instances, the metal plate at the top of the fixture supporting the sockets has been silvered to act as a reflector and to increase the effectiveness as far as possible.

In the halls above the fourth floor, glass globes have been provided to screen the lamps. These globes, made according to the specifications of the electrical engineers, are unusual in the fact that the intrinsic brilliancy of the lamp is reduced without an excessive loss in the efficiency, and at the same time, a warm, pleasing opal glow is produced.

The lighting of the auditorium is the most effective and probably the most interesting feature of illumination in the building. The result was obtained by the complete co-operation

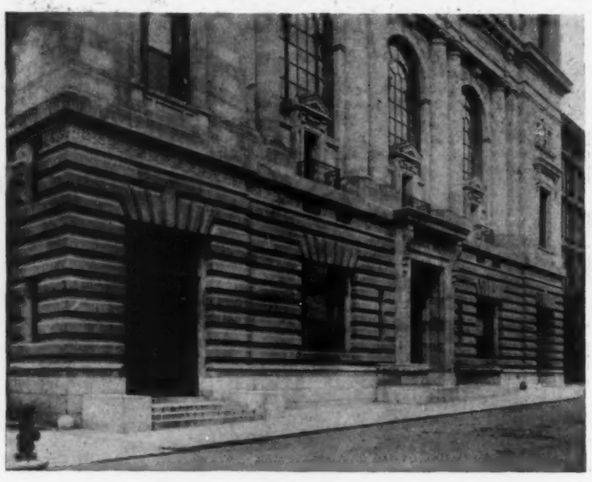


FIG. 3.—THE LOWER FACADE OF THE BUILDING.

of the electrical engineers with the architects. At the engineers' suggestion, the architects provided a space of about 15 ins. between the ceiling of the auditorium and the beams of the floor above. At the suggestion of the engineers, also, a glass septum was substituted in place of the proposed plaster panels in the ceiling. The details were then carefully worked out as to obtaining access to the lamps for renewal, and tests were made by the engineers to find a glass that would reduce the intrinsic brilliancy or glare, and at the same time would not have a

prohibitive amount of absorption. The result obtained has been very satisfactory, and it is possible to sit through an entire lecture without being disturbed or distracted by the lighting. The general effect is both soft and pleasing, and resembles or suggests sunlight passing through glass, as at Napoleon's Tomb in the Invalides, in Paris. As a matter of fact, the solid arches of the floor above are within 2 or 3 ft. of the glass through

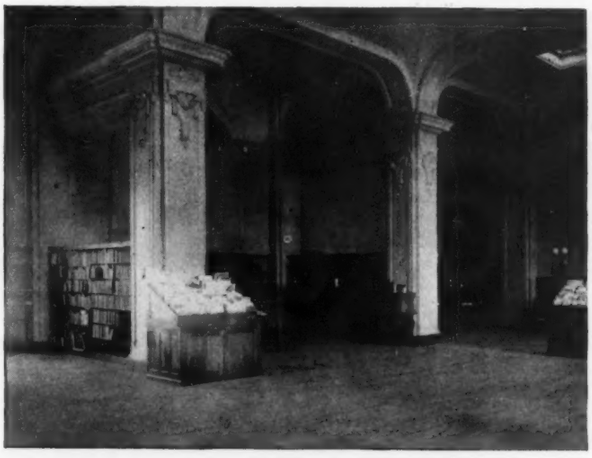


FIG. 4.—LIBRARY, LOOKING EASTWARD FROM ELEVATOR ENTRANCE.

which the light passes. Additional lamps screened by the same kind of glass are provided at the rear and at the sides under the balcony. Dimmers are provided for reducing the amount of illumination in the auditorium to any desired point, and also for the purpose of gradually increasing the illumination to the maximum, after the room has been darkened for a stereopticon, thereby avoiding the unpleasant sensation produced on the retina of the eye by flooding the room with light immediately following comparative darkness.

The lighting of the assembly and lecture rooms was also designed to prevent the lighted lamp from being distracting or unduly noticeable. For this reason, the cove method was adopted, with additional outlets in the ceiling for supplemental fixture lighting. The difficulties of the building construction did not admit, in all cases, of obtaining continuous coves, nor coves of the exact form and dimensions desired. While the cost of lighting by this method is in excess of that using exposed lamps, the fact that the rooms are not in continuous use, but occasionally, for lecture purposes, offsets this objection.

The general illumination of the library is obtained by means of lamps placed above the glass ceiling skylight on a plan similar to that used in the auditorium, the glass in the ceiling skylights being of the same kind as that used in the auditorium ceiling. In addition, ceiling outlets are provided for general illumination, so that the indirect lighting above the glass need be used only at certain times. The light for reading is obtained by means of standard fixtures placed upon the tables. The general effect is charming and agreeable.

The specifications and plans for the electrical equipment, the illumination, electric fixtures, etc., were prepared by Messrs. C. O. Mailloux and C. E. Knox.

ELECTRICAL ENERGY SUPPLY.

As noted before, the supply of electrical energy to the building is furnished from outside and not from an isolated plant. The New York Edison Company reaches the building by means of two 1,000,000 circ. mil cables; one being a bifurcation of its feeder from East Thirty-Ninth Street to Thirty-Eighth Street and Fifth Avenue; and the other being a direct feeder from the West Thirty-Ninth Street station, situated a few hundred feet to the west of the building. There is a 500,000 circ. mil service from the main on the north side of the street, and a 350,000 circ. mil service from the main on the south side of the street. In addition there is a United Electric Light & Power Company's service for 60-cycle alternating current.

At the switchboard the installation of the building is divided into two parts. One feeder and one service from a main supplies one part, and the other feeder and the service from the other main supplies the second part. Either pair of services is sufficient to take care of the whole building. Double-throw switches are arranged so that ordinarily half of the installation is supplied from each pair of services; but in case of interruption on either pair, the double-throw switch may be thrown so that the full load of the building can be supplied from one.

ELECTRIC ELEVATORS.

The elevator shaft for passenger travel occupies the middle part of the western wall of the building. There are two Otis passenger elevators, 3100 lbs. maximum load, speed 325 ft. per minute with 2500 lbs. load. These elevators are of the latest type electric drum machines, being equipped with double screws, compound momentum brakes, automatic stop motion switches mounted on the drum shafts for limiting the car travel at either end, hoistway limit switches, slack cable switches and emergency brakes.

The cars are fitted with the improved wedge clamp safety device which grips the guides if a car is descending at undue speed. Each car is counter-balanced with very nearly its own weight, and to the back of each drum is attached a separate weight equal to the average load carried in the car. This arrangement of counter balance gives the most economical results in energy consumption. In addition to the wedge safeties, the elevators are equipped with the security retarding safety, which acts independently of the other safeties.

The elevators are controlled by means of hand operating switches conveniently located in the cars, and, in case of accident, the electrical supply to the machine and operating switch can be entirely cut off by the operator, and the emergency brake applied by opening a small switch, known as the safety switch, which is located near the car operating switch above referred to.

The freight elevator has a maximum lifting capacity of 3000 lbs.; speed with a load of 2500 lbs. is 250 ft. per minute. This machine, which is also a lifter of safes, is provided with a back gear attachment that can be readily connected or disconnected by the engineer by means of which the machine can be made to lift 5000 lbs. at a low rate of speed.

A locking device is also provided for holding the car securely

FIG. 5.—VIEW OF FOYER ON GROUND FLOOR.

at any floor level while loading or unloading. In all other respects this elevator is similar to the passenger elevators. The plant is operated on the 110-volt direct-current circuit.

TELEPHONE EQUIPMENT.

Realizing that in a building of this nature the most up-to-date engineering ideas would be embodied in every feature of construction and administration, a careful study was made of the needs of the founder societies and the other tenants in the building with respect to the telephone service, in order that the

plant might be adequate and the telephone service thoroughly efficient. Such a study indicated that the most convenient and flexible, as well as the most economical service could be effected by arranging for one switchboard for the entire service throughout the building from which all of the trunk lines to the central office of the telephone company should extend, and in which all the extension telephones in the buildings should terminate.

Accordingly, a specially designed single-position switchboard to include all the most modern features, and finished to harmonize with the architecture of the building has been installed. At the present time the switchboard is connected to the Bryant central office of the telephone company by means of seven lines, which may be used for incoming and outgoing traffic; and there are 38 extension telephones connected to this board and located throughout the building. The switchboard has an ultimate capacity of 15 central office lines and 60 extension telephones. This gives the building a flexible telephone service, since from any telephone at any point in the building communication may be had with any other telephone in the building or with any local, suburban or long distance point through the lines of the New York Telephone Company and its sister telephone companies.

Telephones have been installed in the offices of the three founder societies, and, in addition, in the engine room, service halls, coat rooms, library, the stack rooms, at the demonstrating tables, to be used by the lecturers, in the janitor's quarters, and at all points of activity.

It is estimated that about 12,000 messages per year will originate from the telephones in this building, and the contract to cover this number of messages has been arranged for. In addition to the telephones throughout the building, three booths have been installed on the ground floor in order that visitors to the building or tenants may send messages from this point.

A thoroughly modern and effective ventilating apparatus is provided for the lower six floors, which contain the large assembly rooms. Fresh air in large quantities is supplied to all the rooms and the main corridors in the lower six floors by means of four electric-driven Sturtevant blowers located in the basement. Air is exhausted from these floors and from the basement, as well as from the toilet rooms throughout the building, by means of four electric-driven Blackman exhaust fans located in fan houses on the roof. C. and C. electric motors are installed for driving the blowers and exhaust fans.

A Successful Municipal Lighting and Power Plant.

MUNICIPAL ownership in the electrical field is of so comparatively recent origin in this country that its success or permanency as a feature of American political economy cannot as yet fairly be judged. It is the custom of its opponents to point out the numerous examples of failure as proof positive of the impracticability of this institution as a permanent agency for controlling industries and undertakings of a public service nature. On the other hand, radically-inclined publicists and economists cry forth every instance of successful operation as certain evidence that municipal control is the only solution of transportation and other public service problems.

HISTORY, DEVELOPMENT AND GROWTH.

Sixteen years ago the city of South Norwalk, Conn., then a thriving industrial town of about 4500 inhabitants, was supplied with electric light and power by a local private firm. Operating without competition this corporation lighted the streets with unreliable arc lamps of 800 nominal candle-power for periods and at prices arbitrarily fixed to suit its convenience, regardless of repeated public protest and demands for longer and better service.

All remonstrances proving vain, the citizens voted an appropriation of $22,500 for the establishment of a municipal plant. This was in 1892. A committee of three was appointed by the city to direct the new construction. Albert E. Winchester, then central station designer with the old parent Edison interests in New York and residing in Norwalk, was selected to design and supervise the work. In course of time he identified himself with the enterprise, making it his life work. That the South Norwalk plant is a model of administrative and technical efficiency is due in a large measure to the devotion of this engineer. The purely economico-scientific value of South Norwalk's success is therefore weakened as an argument in favor of municipal ownership by the overshadowing effect of unusual devotion and capacity of one individual. How much of the success is due to the system of municipal control, how much to the exceptional individual cannot be determined. It will furnish opponents in argument this ready weapon: "Where a capable individual uses his personally into the principle of public ownership, that very force of personal incentive is furnished, which is the mainspring of success in private control." Cases where real capability is willing to renounce its personal advancement for the sake of principle are rare, and it is neither wisdom nor policy to justify general adoption of an institution dependent upon such abnegation for its success.

On land purchased by the committee at South Norwalk, a 100-hp plant began supplying electricity to 86 open-series arc lamps on city-owned pole-lines, on Friday, Oct. 13, 1892. The

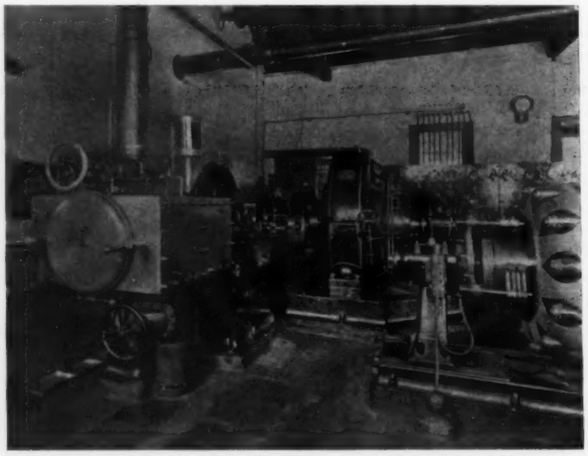


FIG. 1.—CORNER OF DYNAMO ROOM, SOUTH NORWALK MUNICIPAL PLANT.

fire alarm system was transferred from the fire department to be incorporated with the electric works—a departure in public service which has proven singularly advantageous.

After several years of public lighting the results were so encouraging that on petition to the Council, a committee was appointed to report on the advisability of enlarging the plant for the purpose of extending the service to commercial lighting. Mr. Winchester, then one of the electric light commissioners, was selected to conduct the investigation. A favorable committee report led to an appropriation of $20,000 for commercial addition in October, 1897. All the work was designed and supervised by Commissioner Winchester. Commercial lighting supply began Aug. 1, 1898. The following October the most important and distinctive feature of this system of control was instituted when, with the Council's sanction, all the private and street lighting systems were put on a commercial basis, fixed charges being established for all output of the plant so as to enable it to pay its expenses from its own income; just as under private ownership. In the history of municipal ownership South Norwalk will shine as the pioneer in operating a municipal electric plant from an independent business standard entirely divorced from politics.

Business increased so rapidly that on May 15, 1900, $17,500 were appropriated for enlargement, followed by $20,000 in 1903. In the course of these extensions and renovations all of the original equipment of dynamos, engine and lamps was retired after 11 years of very satisfactory service. In 1901 the

electric system of a local company, operating under the partial control and part ownership of the city, was purchased outright by the Commissioners, very materially extended and connected with the city's generators. The city was now operating a complete public and commercial electric service, having practically driven out all competition by natural growth and survival of the fittest. Although the successor of the old opposition company has control of the street railway system and supplies the city with gas, it actually has but 1 per cent of the customers for electricity. The private and municipal interests are now on the most friendly terms, the one confining itself to the gas field, the other to the electrical.

So satisfactory was the service and so rapid the growth that by the end of 1904 the Commissioners were confronted with the fact that another enlargement would have to be made in time to meet the fall load of 1905. The plant had practically outgrown its space limitations. An increase of boilers which was necessary if the increased output was to be attained by adding steam units, would necessitate removal of the whole generating plant to the city's property at the water front in order to secure direct boat delivery of coal and convenient condensing facilities. In view of the great trouble and expense, such movement had to be avoided if any suitable alternative could be found. After an exhaustive investigation it was decided that the installation of an American Diesel Engine Company's 225-hp fuel oil engine directly connected to a 165-kw Fort Wayne generator would furnish the required increase of power at increased economy without need of moving the plant. The Council having endorsed the Commissioners' report advocating the proposed enlargement at a cost of $22,000, a city meeting appropriated the estimated amount on June 12, 1905. All material for increasing and extending the distribution system was purchased by the Commissioners direct and the work entailed was performed by the regular operating staff with temporary help. Just four months, after the enlargement was authorized, the new engine and generator were started under trial load.

The flexibility of the South Norwalk municipal works system was shown at this time by its opening a steam heating system for heating the passenger coaches of waiting trains of the New York, New Haven & Hartford Railroad Company. Though this forms but a small source of revenue, it is important as indicating on the part of the plant management a degree of initiative and readiness to avail itself of every commercial opportunity, wholly at variance with the reluctance to extend and the "hide-bound" supineness so frequently complained of as incidental to municipal control. The same appreciation of technical advances and readiness to discard antiquated equipment or methods may be traced throughout the career of this plant. They prompted the weeding out of the whole original outfit in 1903, and especially in the radical departure from steam to fuel oil power generation in 1905.

The plant is the result of a natural and healthy growth. After 1898 the numerous expensive enlargements were paid for, not out of bond issues or loans, but with notes endorsed by the City Treasurer. These notes have been largely redeemed and will be entirely redeemed from the profits of the plant, which also carry the entire interest load of debts contracted for the plant's erection and progressive enlargement. For instance, the annual statement of Jan. 1, 1906, reported a total debt of $85,400.01, that of Jan. 1, 1907, a debt of $74,694.51, showing a reduction of $10,705.50 all out of the business of the works. In addition to this $3,445.81 were paid for interest.

PLANT AND EQUIPMENT.

Considering the fragmentary growth of this plant it is singular that it presents the appearance of a unitary conception embodied in one comprehensive design. The main building of brick, one and one-half stories high, 109 ft. long and 48 ft. wide, contains in the fire room four 125-hp tubular boilers, a feed-water heater, injector and the ordinary boiler room appliances, excepting that the unusually complete arrangements for weighing coal indicate an appreciation of systematic and accurate data collection.

All of the steam engines are of the Watertown high-speed type each direct-connected to 250-volt direct-current, multipolar generators. Of the latter two are 60-kw Siemens & Halske, two are 60-kw Eddy, and one is a 165-kw Fort Wayne dynamo. The Diesel engine is direct-connected to the latter generator which carries the main part of the load. This engine is run practically all the time and is credited with an average of two-thirds of the entire monthly output of the plant. A Norwalk air compressor belted to a 25-hp General Electric 250-volt motor is used to compress to about 800 lbs. per square inch the air used for injecting the sprayed fuel oil into the engine cylinders. A cylindrical fuel oil storage tank containing 3350 gals. is placed underground close to the plant. From the storage tank oil is pumped into an accurately gauged distributing tank which enables positive check to be made on all oil consumed. At the present price of 3¾ cents per gallon, the fuel cost per kw-hour is 3½ mills. The following data will be of interest as showing the unusual efficiency and economy of the South Norwalk Electric Works:

Average income per kw-hour	$ .04479
Average cost per kw-hour, including int., depr., exp. and opr.	.02764
Average profit kw-hour	.01715
Gallons of fuel oil consumed last year	59,163 gals.
Pounds coal consumed last year	2,500,810
Average cost of coal per kw-hour	.02250
Average cost of fuel oil per kw-hour	.00359
Average pounds coal per kw-hour	8 lbs.
Average Watt hours per gollon fuel oil	9,916
Average Watt hours per pound coal	114

The streets are lighted by direct-current series enclosed arc lamps of 1400 nominal cp on two circuits having 13 miles of wire and a total possible capacity of 130 lamps spaced at an average distance of 500 feet apart. These lamps were lighted

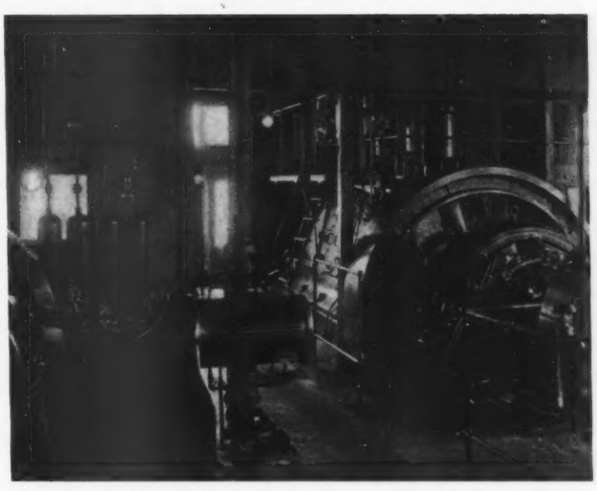


FIG. 2.—DIESEL OIL ENGINE SET IN SOUTH NORWALK MUNICIPAL PLANT.

357 nights during the past year, each lamp averaging 3287 hours of service at a cost of $.0182 per lamp per hour. The increased economy achieved by the oil engine is shown by the comparison of 246 watts supplied per hour for one cent in 1906 with 191 watts produced in 1905, although this record would appear even more favorable had not the oil engine been used for two and one-half months during that year.

The commercial lighting and motor services are continuous—24 hours per day. There are 460 consumers of electricity for lamps and 60 for motors. Lamps equivalent to approximately 10,000 16-cp, and motors aggregating 598 hp in capacity are connected, the kilowatt rating of generators being 565. Last year 872,372 kw-hours were generated, 586,872 by the oil engine set and 285,510 by the others. The average income per kw-hour was 4.479 cents, at a cost of 2.764 cents. The average cost by fuel oil was 2.25 cents, as compared with 3.59 cents by coal. However, these figures do not actually apply to the whole showing because the cost of coal per kw-hour is disproportionately high because steam was used as an auxiliary and to carry peak loads only. The Commissioners estimate that the cost of street lighting last year was $6,540, which is $1,526 less than it

would have cost if paid for at the rate of $74 per lamp year charged the adjoining city of Norwalk by a private company. At the average rate of $83.71 obtaining in Connecticut the total saving for the city since the starting of the plant has been $21,478.09. What profits have accrued to private consumers may be judged from the comparison of base lighting rates of 10 cents stepped down to 6 cents per kw-hour with 10 per cent rebate for cash charged by the municipal plant and 16 cents with 10 per cent rebate charged by the private lighting company. For motors the municipal plant charges by a step rate from 5 cents down to 3 cents per kw-hour with 10 per cent rebate for cash. A comprehensive view of the results obtained by the South Norwalk Electric Works may be obtained from the financial statement published Jan. 1, 1907, as a report of the Commissioners to the Council and here reproduced:

Resources.

Land and buildings	$10,391.67
Motive power system	44,521.63
Electric generating system	19,904.31
Distributing system	35,429.85
Miscellaneous equipment	1,525.76
Legal expenses, rights, title	5,639.60
Supplies carried to 1906	370.41
Cash carried to 1906	25.06
1905 accounts receivable	4,792.06
Total	$122,600.35

Liabilities.

1892 bonds, street light system	$22,500.00
1898 bonds, commercial system	20,000.00
1900 notes, commercial enlargement	4,000.00
1903 notes, meter installation	4,000.00
1905 notes, commercial enlargement	4,000.00
1905 notes, commercial enlargement	19,000.00
Bills payable	1,194.51
Total debt	$74,694.51
Surplus	47,905.84
Total	$122,600.35

Operating Expenses.

Repairs	$2,930.83
Interest	3,445.81
Salaries	7,715.97
Material and supplies	3,316.69
Miscellaneous expenses	977.01
Total operating expenses	$24,293.48
Gross gain or profit	14,783.55
Total	$39,077.03

Receipts.

Municipal lighting (streets and bridge)	$6,640.80
Municipal department lighting	568.20
Commercial light	24,932.04
Commercial power	6,836.00
From loan to 1905 enlargement	99.99
Total	$39,077.03

Operating Resources.

Income for year	$39,077.03
Cash carried over to 1906	308.49
1905 accounts collected	3,377.10
Total	$42,762.62

Disbursements.

Operating expenses (less bills payable)	$23,098.97
New construction account	2,845.55
Reduction of debt (notes taken up)	12,000.00
Cash carried over to 1906	25.06
1905 accounts receivable	4,792.06
Due from fire alarm appropriation	.98
Total	$42,762.62

In every way this plant has been a source of profit and credit to the community. It is estimated that the population of South Norwalk is now over 10,000, or more than double what it was when it started its electric plant, and the same is practically true of its assessed valuation. Aside from its own population it supports at least 5000 people in its factories, who live outside of its limits. Particularly interesting is the fact that no breath of "graft" suspicions has ever been connected with these works. The operating staff consists of A. E. Winchester, general superintendent (who is also city electrical engineer and chief of the fire department), one clerk, two engineers, three firemen, a meterman, line foreman, one lineman and two trimmers. They are entirely controlled by the three electrical commissioners appointed for three years by the Council, which is elected annually. By stipulation and common consent it is arranged that the electrical committee and that in charge of the waterworks shall always be divided between the two principal political parties.

There are no inherently efficient safeguards of municipal ownership as a system in the experience of South Norwalk which may be transplanted; each case must stand or fall by its own merits alone. It is unquestionably a success in this instance under the advantageous conditions of a highly intelligent community in a very prosperous manufacturing section, having dedicated to it the entire energy, ambition and skill of a competent engineer, with the confidence and encouragement of three first-class business men of the highest order of integrity and intelligence as Commissioners to back him. Natural recognition of the importance and value of this work has been given Mr. Winchester by his appointment by the National Civic Federation as a member of the commission sent to England last year to investigate and report on municipally-owned undertakings abroad.

Notes on a Central Station Card Record System.

By Geo. W. Martin.

The efficiency of the commercial side of central stations is a matter which has been emphasized in no small degree within the past two or three years. One of the factors which largely affects this efficiency is the manner in which are kept the records of the company's business and its property. "System" has been of late years the watchword of all commercial organizations and to none is it more important than the central station.

In the hope, therefore, that particulars of the card record system of a large central station will be of interest as suggesting improvements or additions to existing systems, some notes are given here of the manner in which the United Electric Light and Power Company, of New York, keeps track of its customers and the apparatus in use by them.

When a prospective customer applies for service, a contract is made out and placed in an envelope, shown in Fig. 1, on which

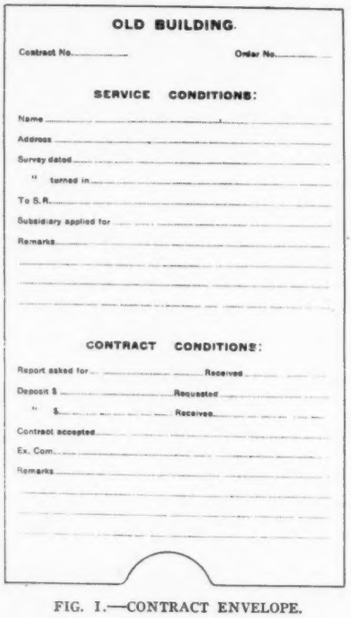


FIG. 1.—CONTRACT ENVELOPE.

are given the service conditions and also the conditions of the contract. If the building is an old one, the envelope bears the title shown; if new, a similar envelope headed "New Building" is used. Before the contract is accepted, a survey of the premises is made by the construction department if service is not yet available at that place. The cost of installation and the revenue are estimated and the whole matter is turned over to the executive committee of the company for approval. If the contract is accepted, the date of acceptance is placed on the line under "Contract Conditions." On the line below, in case the building is a new one, is placed the date of approval by the

executive committee. New and old buildings are filed separately so that the company may readily determine the number of new buildings cut in within a certain time.

The contract being accepted, the survey is turned over to the subway record department, the date being given on the line "To S. R." The date on which the company applied to the subway company for the "subsidiary" connection, as it is called, is given on the line below. If the contract be not accepted, the contract is kept in the envelope and filed for reference.

All the preliminaries regarding the contract having been settled, a card, shown in Fig. 2, gives the customer's name and address, the contract number, the date on which the contract was taken, and the classification of the order, whether cut-in, cut-out, sundry sale, or miscellaneous. The first two orders are, of course, for connecting or disconnecting the customer's installation. The sundry sale order is for material not supplied under the regular contract, such as extra cable, extra arc-lamp carbons, or extra incandescents. The miscellaneous order, as its name implies, is for material not covered in the other orders. The order blanks are in book form in triplicate, one original and two carbon copies, one order being issued to the storekeeper, one to the party doing the work, and the third being kept for office memorandum.

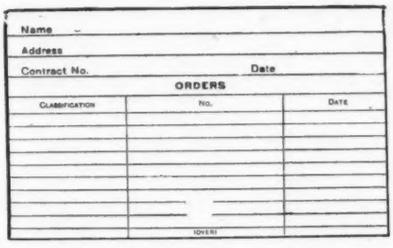


FIG. 2.— PRELIMINARY CARD.

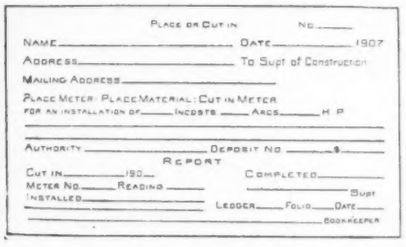


FIG. 3.—CUT-IN ORDER.

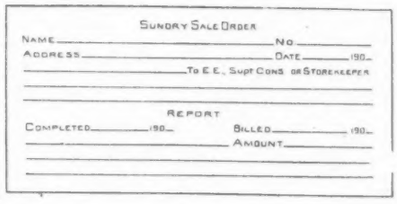


FIG. 4.—SUNDRY-SALE ORDER.

The form for the cut-in order is shown in Fig. 3. It is addressed to the superintendent of construction and calls for the placing of a meter, installing lamps or fuses, or cutting in the meter. If the meter and wiring are already in place, of course all that is necessary is to cut in the meter. Hence "Place Meter; Place Material" are crossed out, as otherwise the storekeeper would send out a meter and the necessary material. The authority called for in the order is the contract number. After the work has been done, the report is filled out by the workman and signed by the superintendent and the bookkeeper.

The cut-out order is similar to the cut-in order, save that "Discontinue Service; Remove Meter; Remove All Material" are substituted for "Place Meter," etc., and in the report "Material Removed" is specified.

Fig. 4 shows the form of the sundry sale order, which is addressed to the electrical engineer, the superintendent of construction, or the storekeeper, as the sale may call for. Thus, a sale order for cable would be addressed to the electrical engineer, an order for arc-lamp carbons to the superintendent of construction, who has all arc lamps in charge, and an order for extra incandescents is addressed to the storekeeper. The miscellaneous order blank has no special features. As in the other orders, a space is provided for reporting the order filled.

The numbers of these various orders and the date of each are placed on the card shown in Fig. 2, which thus affords a ready means of ascertaining the extent of the company's business with a customer. The value of this will be realized when it is said that before adopting this system the files of the four different classes of orders had to be looked over to find out what orders had been filled for a customer.

The company makes no distinction in the card records of the class of service given, whether for residence, church, or business, save in one case, that of apartment houses, and here the large number of names appearing under one address made a distinction desirable. A master card, shown in Fig. 5, gives the address and the name of the building, the number of hall lamps which supply the only light paid for by the owner, the size of motor for operating the elevator, or other power, the meter number, and the name of the owner. In the upper right-hand corner is placed the number of the district covered by the meter reader. The reason for giving the name of the building is stated to be that tenants sometimes forget the number of the street while they remember the name of the apartment house.

The master cards are filed according to street location, and with them are filed the tenants' cards, shown in Fig. 6, giving the street address and number of the apartment, the number of lamps, the meter number, and the name of the tenant. The number of the meter reader's district is also placed on these cards as on the master card.

These cards are filed according to the number of the apartment, and so in going over the file one can readily see by the missing numbers which apartments are not using the service. This is of importance in soliciting business from the non-users. For example, when the solicitor looks over the cards of a certain apartment house and finds that not all the tenants are using electricity, he makes out a list of those using it, on a form upon which the address of the apartment house is given, and opposite the number of the apartment of each user is placed the name, written in ink. The solicitor then calls at the apartments not having the name of the tenant on his list, learns the name and writes it in pencil opposite the number of the apartment. He also obtains the business address of the tenant if possible, as it is sometimes necessary to see them at that place. If the apartment is vacant, a "V" is placed opposite the number. By the use of this list, then, the solicitor can tell just to what points he must apply his energy to secure new business. This list is also used as a mailing list for advertising matter.

For its apartment house work, the company employs one solicitor, a man of good address, the success of whose work is attested by the fact that he canvasses nearly 500 buildings with excellent results. At the end of 1906, the company had 332

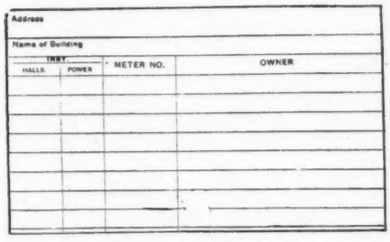


FIG. 5.—MASTER CARD.

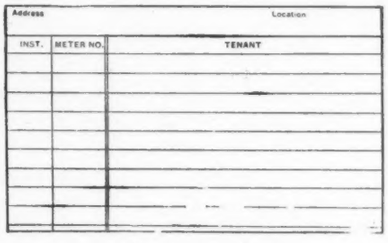


FIG. 6.—TENANTS' CARD.

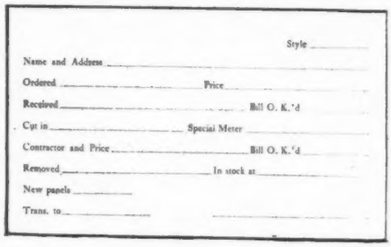


FIG. 7.—SIGN CARD.

buildings of this class on its circuits with a total of 6373 customers; at the present writing, the number of buildings has increased to nearly 500, and the number of customers in proportion, a total of something over 9000.

The card system by which the company keeps track of the signs in service and those in stock is a particularly interesting one. Figs. 7 and 8 show the face and back of the card on which the record is kept. When a sign is installed, the customer's

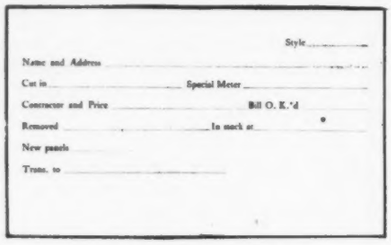


FIG. 8.—SIGN CARD.

name and address are placed on the card, with the style of the sign, the date on which it was ordered, its price, the date on which it was received, the date on which service was cut in, and the number of the special meter, in case one is installed to separate the current consumption of the sign from the other lighting. The wiring is installed free, and the name of the contractor and his price for doing the work are placed on the card. Both this bill and the sign bill are audited by the official having the matter in charge, the date being placed in the space indicated.

If the sign be removed and placed in stock, the date of removal and location of the stock room are placed on the card. If while the sign is installed, the customer moves from the premises and the new tenant wishes to use the sign with different lettering, or if a customer wishes to change the panels, new panels are ordered and the date placed on the line provided on the card. In the case of a new tenant using the sign installed for a former tenant, the new tenant's name is placed on the last line of the card, and the reverse side is also filled out as explained for the face side. If the same sign is used by a third tenant, the latter's name is placed at the bottom of the reverse side, and a new card is filled out and filed, the old card being placed in the "In Stock" box. This card thus shows the different customers who have used the sign and gives its complete history up to the present.

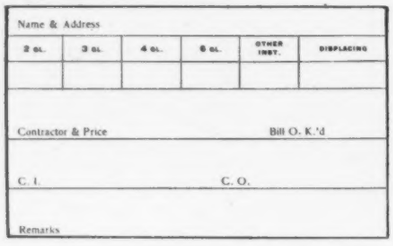


FIG. 9.—NERNST LAMP CARD.

When a new sign is ordered for a customer, the card is placed in the "Ordered" box until the storekeeper notifies the office that the sign has been received. After the sign is placed, the card is then filed in the "In Service" box. A duplicate card is made out and given to the superintendent of construction, who has charge of lamp renewals. When a sign is removed, the superintendent of construction returns his card, which is placed in the "In Stock" box. The other card is taken from the "In Service" box and placed in the "Dead Wiring" box. By looking over the records of "In Stock" and "Dead Wiring," one can determine whether a prospective customer has on his premises sign wiring installed for a previous customer.

When sign service is applied for, the "In Stock" and "Dead Wiring" files are gone over, the cards being filed geographically, and in many cases it has been possible to use old signs and wiring for new customers, thus effecting a material saving in the cost of the installation.

In conclusion, it may be of interest to note the card for recording the installation of Nernst lamps. The face of this card is shown in Fig. 9 and on the reverse side spaces are provided for keeping a record of the monthly consumption. As the card shows, the number of lamps of the various sizes is given, also whether any other illuminants are in use, and the illuminants displaced by the Nernst lamps. If they displace other than electric illuminants, the wiring is installed free. This practice is also followed with arc lamps. The date of cutting in is given and also the date of cutting out when service is discontinued. In the latter case the card is placed in the "Dead Wiring" box.

The company has at present sixteen customers using Nernst lamps and twelve more contracts have been accepted. For the twenty-eight customers, the sizes of lamps are as follows: 29 three-glower; 37 four-glower, and 7 six-glower. Those actually in service are 6 three-glower; 22 four-glower, and 3 six-glower. The small number of customers using Nernst lamps is due to the fact that the company has made a limited appropriation for this service to form an idea as to the advisability of extending it.

The Central Station and the Electric Vehicle.

One of the most serious difficulties encountered in the operation of electric lighting stations resides in the fact that the lighting company has almost no control over the time-distribution of its product. That is to say, the customer and not the company determines the station load curve and the load factor. By using maximum-demand indicators or employing discriminating rates, the company may, however, induce the customer to limit his maximum load and may encourage the use of equipments that employ current during the daytime only or over long hours without notably increasing the lighting peak load.

On account of the great importance of avoiding peaks and of maintaining a constant load on the generating equipment, lighting companies have frequently resorted to the use of storage batteries. The particular advantage of the battery is due to the fact that it affords a load for the station when wanted, and assists the station in carrying the load peak. Second only to the station battery in its desirable characteristics would be an equipment whose load can be adjusted at will and which never comes on during the lighting peak. Such an equipment may be found in the electric automobile provided the central station company has control of the charging circuits.

The electric vehicle is undoubtedly holding its own for certain services in competition with gasoline machines, and has reached a position such that it cannot be ignored by electric lighting companies as a desirable energy-consuming device. Moreover, the electric automobile, having passed through the experimental period and the "fad" period, and undergone many set-backs due to various misrepresentations and misunderstandings, has emerged as a well-designed engineering product. That it is not merely a carriage with the addition of a motor equipment, will be evident from the following brief notes on the constructive features of commercial lines of electric automobiles, gathered during recent visits to a number of automobile works.

In the methods employed in utilizing the power of the motor in propelling the vehicle and in controlling its speed, numerous differences are found to exist. Some of these relate to minor changes in the mechanical arrangements, while others deal with the fundamental characteristics of the electrical equipments and the service demanded of the vehicle. Depending upon the type of vehicle, some makers prefer to connect all of the driving ma-

chanism to a single framework upon which the body is mounted, while others attach the driving mechanism directly to the body itself, which is properly strengthened for this purpose. In some cases the speed control is obtained without varying the main circuit voltage from the storage battery, while in others the cells are arranged in groups which are connected in series or parallel as desired. Each method employed possesses certain advantages and disadvantages, which have evidently been carefully considered by the various engineers responsible for the design of the equipments. What may prove of great advantage for certain types of vehicles may be of minor importance for others, while a construction which would prove undesirable for one type may be advantageous for others.

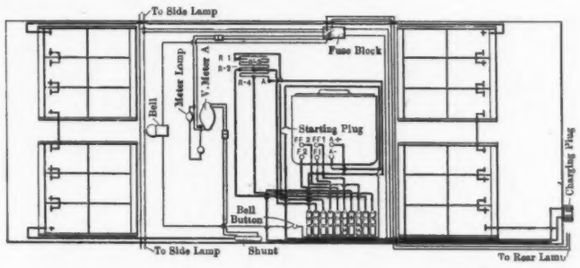


FIG. 1.—WIRING DIAGRAM FOR BAKER EQUIPMENT.

The following outline of methods of constructing vehicles as employed by several different companies is intended not as a catalogue of the vehicles manufactured or as a directory of the makers, but rather as an indication of the fact that the design of electric vehicles has long since passed through the experimental stage and is now upon an engineering basis.

As an example of an electric pleasure vehicle using framework upon which the body is mounted and to which the driving mechanism is attached, may be mentioned the "Baker," as manufactured by the Baker Motor-Vehicle Company, Cleveland, Ohio. The frame work is made either of pressed steel or of armored wood. An Elwell-Parker or General Electric motor is mounted either under a hood in front or under the driver's seat. In every case double reduction gearing is employed. The

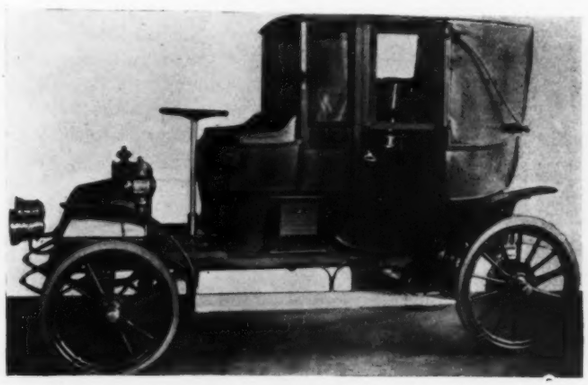


FIG. 2.—WOODS EXTENSION LANDAULETTE.

motor drives a silent chain which imparts motion to a counter-shaft connected through either a chain-drive or bevel gears to the differential mechanism on the rear axle. The battery consists of from 14 to 40 "Exide" cells arranged mechanically in two sections to distribute the weight, but connected permanently electrically in series. The motor is of the series-wound type, and is constructed with four poles. By arranging the field coils in various combinations of series, series-parallel and parallel, four running connections are obtained without series resistance. A starting resistance, however, is always used, and this same resistance is inserted at an intermediate point so that there are obtained six forward speed points. The controller is of the single-lever reversing type and permits of three rearward speed points. The lever is mechanically so arranged that it cannot inadvertently be thrown from the forward to the reverse position without stopping at the "off" position.

In the "Woods" electric pleasure vehicle, made by the Woods Motor Vehicle Company, Chicago, Ill., the working mechanism is assembled on a manganese bronze frame which is independent of the remainder of the vehicle. The motor drives a counter-shaft through "herring-bone" gearing. On each end of the counter-shaft is mounted a sprocket which drives a rear wheel by means of a separate chain. The differential mechanism forms a part of the counter-shaft, so that the driving mechanism is entirely self-contained. Each vehicle is equipped with 40 "Exide" cells arranged both mechanically and electrically in two sections. The motor is of the four-pole "Woods" type, the two halves of the field coils being arranged for either series or parallel connection. The controller gives a total of four-speed points, each without resistance in series, which are obtained as follows: Battery sections in parallel; field coil sections in series; battery sections in parallel; field coil sections in parallel; battery in series, field coils in series, battery in series, field coil sections in parallel. A reverse lever is provided external to the main controller, so that four rearward speed points are obtained.

The Pittsburg Motor Vehicle Company builds no pleasure carriages, but turns out a line of delivery wagons and trucks, varying in carrying capacity from 500 to 10,000 lbs. of paying load. For all types of cars built, some form of wood-armored frame is used, and in most cases the frame is integral with the wagon body itself. In addition the body is further stiffened for the severe service to which automobiles are subjected. Such construction cuts down directly the total weight of the vehicle, and gives, therefore, a higher percentage of paying load to the total load moved. On all types of cars turned out, Westinghouse series motors are used in connection with a standard type of lead battery. In the lightest delivery cars, a single low-speed four-pole series motor is used with single reduction to a live rear axle by Morse silent chain. At no point on the four-

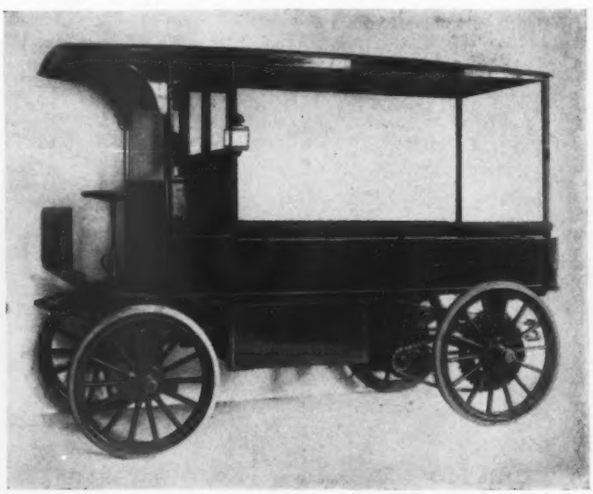


FIG. 3.—DELIVERY WAGON OF PITTSBURG MOTOR VEHICLE COMPANY.

notch controller is there inserted dead series resistance, this being avoided by a series-and-parallel arrangement of the two series field windings, first with the two halves of the batteries in parallel and then in series. A reverse pedal gives the same combinations for driving backward; the pedal is not operative until the controller has first been moved to the "off" position. For both the forward and the reverse speeds the controller handle is pushed forward.

In heavier construction, two-motor drive is resorted to, and both gears and roller chains are used in the driving mechanism. The motor shaft carries a pinion on its end, meshed with a gear on a counter-shaft, the other end of which counter-shaft car-

ries the driving sprocket. With these cars as with the smaller ones, four forward and four reverse speeds are employed. In the two-motor driven cars, however, the battery cells remain in full series at all times and the four speeds are obtained by operating the motors and their respective field coils in series and parallel positions. In all cases where it is at all possible, the speed of the car is predetermined with a view to having the car with its load on the level work the motor on the ascending side of the efficiency curve rather than on the rear of the same. With the car equipment thus designed, they may be expected to operate at a higher effective efficiency than might otherwise be possible.

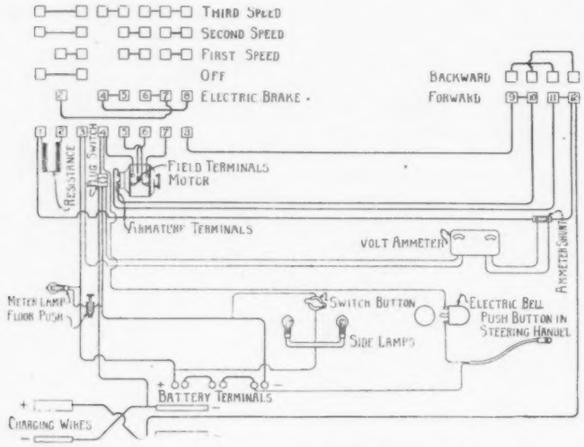


FIG. 4.—WIRING DIAGRAM OF POPE SINGLE-MOTOR EQUIPMENT.

The Pope Motor Car Company, at its Indianapolis factory builds electric pleasure vehicles, light delivery wagons and heavy trucks. Each pleasure vehicle is equipped with a single Pope-Waverly motor which drives the differential mechanism on the rear shaft directly through a "herring-bone" gearing. The casing for the differential is integral with that for the motor pinion, and is made extra heavy, so that the rear wheels, the rear axle, the differential mechanism and the driving motor form a compact unit quite independent of the remainder of the

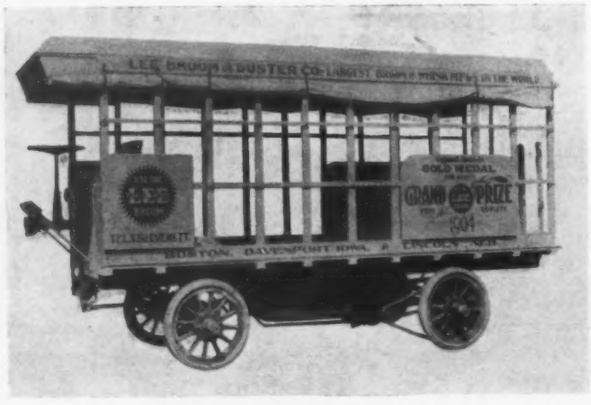


FIG. 5.—POPE-WAVERLY TWO-TON TRUCK.

vehicle. Each vehicle is provided with from 30 to 42 cells of either the "Exide" or "National" type, divided between front and rear compartments, and connected at all times electrically in series. The controller is arranged for three forward and three rearward speed points, an "off" point and a "braking" point, for either direction of motion. The motor is of the six-pole series-wound type; the alternate pole windings are connected permanently in series and the two parts are arranged for either series or parallel connection. At the first speed point, the field coils are in series and a resistance is in circuit; at the second point the resistance is cut out; at the third point the field coil sections are in parallel, no resistance being in circuit. The braking point corresponds to the third speed point, with reversed armature terminals, the starting resistance in circuit, and the battery disconnected. Thus the machine is converted into a series generator with the starting resistance as a load.

On its delivery wagons the Pope Motor-Car Company uses a single Pope-Waverly motor with double-reduction gearing, each rear wheel being driven by a chain from a counter-shaft, the differential on which is connected to the motor through a chain. The method of control is the same as that outlined for the pleasure vehicle. For its trucks the company uses two Westinghouse or General Electric motors, each of which drives a rear wheel by means of a chain. The field coils on the General Electric motors are arranged to be used with an external shunt in order to obtain a practically constant torque throughout the acceleration period. There are five speed points; on the first two the motor armatures are in series, while on the last three the armatures are in parallel. The controller is arranged for two reverse speed points, the armatures remaining in series. The Westinghouse equipment provides for four forward speed points and four reverse speed points, the speed changes being obtained by series-paralleling the two halves of the field coils and the two armatures of the motors.

In addition to the above types of pleasure vehicles, delivery wagons and trucks, mention should be made of special forms of vehicles for use by central station companies and others as described in our columns from time to time.

The rapidly increasing output of electric vehicles from the various factories proves conclusively that as a substitute for the horse-drawn vehicle, the electric automobile is greatly in demand. The electric vehicle in its present form and under present conditions is not a competitor of the gasoline touring car, but it is particularly well adapted for service within a limited distance of charging stations. For use as a physician's carriage or runabout for pleasure or business, as a safe conveyance for ladies and children, as a cab for public service, as a delivery wagon or truck for the merchant and manufacturer, the electric vehicle has no rival.

Although the electric automobile owner is not entirely dependent upon the central station for his supply of electrical energy, yet the fact remains that almost all of the electricity used for automobiles is obtained directly or indirectly from the central station companies. In many instances the policy adopted by the electric-lighting company concerning the accommodations offered for the charging of batteries is the one element which determines whether a prospective customer selects an electric or a gasoline vehicle. It is seen, therefore, that the electric automobile industry is closely related to the electric lighting industry.

It needs no argument to show that a load whose value can be adjusted at will, and which can be placed upon the generators at any time desired, is of great value as a means of improving the load factor of the station. Such a load can be carried after the passing of the evening lighting peak, or during the early morning hours. Moreover, in many cases, where duplicate batteries are used, the charging can be carried entirely as a day load, at a cost to the central station of only a small part of that caused by any excess lamp load during the evening peak.

It is believed that the numerous advantageous features of automobile charging as an adjustable load on the station have not been considered by electric lighting companies as seriously as should be the case. A little encouragement on the part of the lighting companies by an accommodating attitude toward automobile owners, with properly reduced rates for loads not allowed to be thrown on the station during the evening peak, should be followed by an enormous increase in the use of electric automobiles, and experience in numerous cases shows that the lighting company always profits by the business thus secured.

The Small Station and the New Lamps.

By Harry V. Forest.

All are agreed that we are about to see revolutionary changes in the electric lighting business, principally from the introduction of high efficiency lamps. The result to the larger companies will, of course, be a reduction of income, proportional to the rapidity with which they are introduced, but modified some where sliding scale rates are in use. The smaller stations are likely to get more immediate benefits with little or no loss of income. Consider a 16-cp, 56-watt lamp on a flat rate of 50 cents per month, a usual price. This will average the year around from 7 cents to 10 cents per kw-hour. By using the tantalum or tungsten lamp on meter the company should have no trouble getting 12 cents to 20 cents per kw-hour, but, of course, generating considerably less current than before.

Now, how will it pay the small station to use the new lamps? Can it make more profit with them at present rates? Can it give the better service for less money and make its profit by reduction of expenses or increase of business? Or will the effect be to reduce the revenue more than the saving in operation with consequent loss to the plant?

Let us consider the costs of using the different lamps. The renewal costs are as follows:

3.1-watt carbon lamp, 16 cp	⅜c.	per kw-hour
3.1-watt carbon lamp, 32 cp	½c.	"
2.5-watt Gem lamp, 20 cp	⅜c.	"
2.5-watt Gem lamp, 40 cp	½c.	"
2-watt tantalum, 22 cp	2c.	"
1.2-watt tungsten, 40 cp	1.6c.	"

Assumed 75c. cost, 1000 hours life.

The investment of equipment charge, on the basis of $200 per kw capacity, or $7.50 per 50-watt demand, connected load, is as follows:

50-watt carbon or Gem, 15% fixed charges	9.5c.	per lamp	per month
100-watt carbon or Gem, 15% fixed charges	10c.	"	"
44-watt tantalum, 15% fixed charges	8.3c.	"	"
50-watt tungsten, 15% fixed charges	9.5c.	"	"

Figuring average use of commercial light 100 hours per month the year around, gives 5 kw-hours of energy used per month per 50 watt lamp:

Extra station cost only per lamp per month; labor and standy-by losses fixed.

	Plant not loaded.			Loaded to capacity.		
	Coal 1½c. per kw.hr. at lamp.	Free renewals. r.	Free renewals. c. & r.	No renewals. c. & inv.	Free renewals. c., inv. & r.	Cost to estmr. of renewals and current at 10 cents. r. & c.
50-w. carbon	7.5c.	3. c.	10.5c.	17c.	20. c.	53c.
100 Gem	15.	3.	20.	34	39.	1.05
44 tant	6.6	8.8	15.4	15	23.8	52.8
50 tung	7.5	7.5	15.	17	24.5	57.5

The flat-rate revenue per kw-hour with no free renewals will figure out as follows:

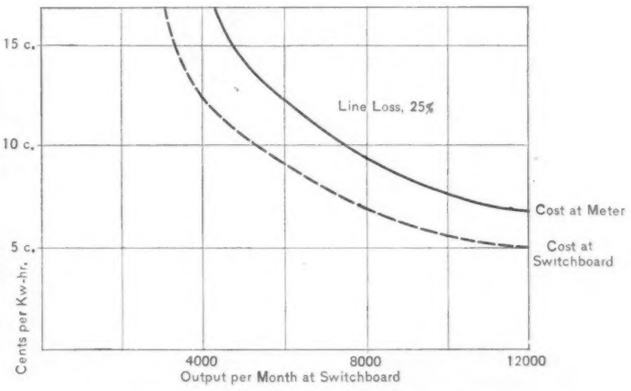
50-watt Gem or carbon, 40c. per lamp per month	8c.	per kw-hour
50-watt Gem or carbon, 50c. per lamp	10c.	"
50-watt Gem or carbon, 60c. per lamp	12c.	"
50-watt tungsten, 60c. per lamp	12c.	"
50-watt tungsten, 75c. per lamp	15c.	"
50-watt tungsten, 90c. per lamp	18c.	"
100-watt Gem or carbon, 75c. per lamp	7.5c.	"
100-watt Gem or carbon, 90c. per lamp	9c.	"
100-watt Gem or carbon, $1.00 per lamp	10c.	"

These figures show that it will pay to use the Gem in all cases instead of carbon lamps, on account of more and better quality of light for same cost. They show that in a plant on a flat-rate basis, not loaded to capacity, by installing tungsten lamps will raise renewal costs 2½ cents per 40-cp lamp per month, and will save in coal 7.5 cents per lamp per month, a net saving of 5 cents each. A plant on flat-rate basis loaded to capacity can nearly double its earning power by using the tungsten lamp. Both plants, if direct current, can use the tantalum lamp to advantage by raising the flat rates to 10 per cent over the 16-cp carbon lamp rates. No free renewals of any lamps should be given on flat rates. Both plants can with advantage allow the use of the new lamps at a 15-cent meter rate, only, with renewals furnished at an extra cost of 1½ cents to 2 cents per kw-hour, thus using the new lamps to work from a flat to a meter basis.

The plant on a meter basis with light load probably needs all the income it can get. But this is an abnormal condition, as plants, except new ventures at the start, are more often over than under-loaded. The better and cheaper light will undoubtedly increase the load to some extent, but if with this increase, with rates in force, the income is not sufficient to keep the plant going, the rates must be raised. Possibly the rates should be raised some anyway, as there is no reason why the customer should get all the direct benefit from use of the new lamps, and leave the company to benefit only indirectly, if at all. They should share the benefits together according to some equitable plan.

The plant loaded to capacity on a meter basis cannot fail to profit by these lamps, as it increases its earning capacity without enlarging the plant. The average rate will be raised some if sliding scale rates are in use, and an extra charge can be made for the new lamp renewals, where carbon lamps are now furnished free, thus giving the customer part, but not all, the savings effected by the new lamps.

The writer thinks that the investment charge should not be figured as an expense for serving new business until the plant is loaded nearly to capacity. This means that small plants on flat-rates, not loaded to capacity, can anticipate the introduction of the tungsten lamp by making flat rates of from 60 cents to 75 cents per 100-watt Gem lamp per month, reap the benefit from the stimulus of cheaper rates for their business, and prevent a sudden change of policy when the new lamps are out. Plants on meter basis can get this same result by temporarily lowering the turning point or quantity of current at which price changes from the high to the low rate. This is, of course, a matter of expediency and is to be determined by local conditions, and also depends upon whether the tungsten lamp when introduced will be all that is anticipated. Explanations should be made so that customers will not continue the low rates on carbon lamps after the new lamps are out.



TOTAL COSTS IN A 100-KW PLANT, FIXED CHARGES INCLUDED.

The writer advocates, where possible, the use of 100-watt lamps for general store lighting instead of smaller sizes, as the tungstens can then be introduced without rewiring, or greatly changing the plan of illumination of the store. Though no mention has yet been made of it, the tungsten lamps will likely be made for 55 volts for series use on 110 volts, as tantalums are now used on 220. The tungsten lamp is especially adapted to this service owing to its self-regulation for varying voltage, and this arrangement will undoubtedly find wide uses and still further reduce the current now used by carbon lamps.

We see by the accompanying diagram how reduction of output increases the cost of energy to the light company. Where with carbon lamps the company was selling 9,000 kw-hours per month at 6.7 cents, by reducing the consumption to 6,000 kw-hours it

would need to realize 9.3 cents for it at the switchboard. But at a 10-cent energy rate the tungsten gives a quantity of light for 57.5 cents that costs $1.05 with the Gem lamp, which shows that there is plenty of margin to raise the rate and benefit the customer besides. But assuming that the new lamps will reduce income at first, and operating expenses slightly, they will also reduce line loss and size of meters needed; they will increase their number of lamps or customers the plant can serve, and by giving better service for less money cannot fail to increase business.

It is the writer's opinion that for residences in small towns electric light with carbon lamps at 12 cents to 15 cents per kw-hour is a little too expensive compared with other illuminants. Of course, people use it, it is so convenient, they can get results with it not obtainable otherwise, and they like to have what other people have. But one argument we have to overcome with prospective customers is that nearly all the electrically lighted houses are so dark-looking outside. They think it must be expensive, for those who have it are so stingy with it. The average customer does not use nearly all he wants, and the conclusion is that reduction in cost will not reduce his bill, and may increase it, not to mention his increased satisfaction and friendship for the company. When the cost is high he will think the company is making too much money and agitate for regulation or municipal ownership. But when the cost is low he will not care how much money we make. Once kill the idea that electricity is "so expensive," and it will be much easier to introduce it for other purposes besides lighting.

The improvements, recent and prospective, in quality of light and reduction of cost are not being made in the electric field alone. The vapor lamps are making rapid progress, and with the introduction of alcohol, with vastly less danger than gasoline, the electric industry will still have strong competition. The best lighted store the writer has ever seen, judging by quality, quantity and distribution of light, was lighted by an inverted mantle gasoline plant. In fact, it was simply beyond comparison with the ordinary electrically lighted store.

It is the writer's observation that most small towns are greatly under-developed from a lighting standpoint. Some towns have ½ lamp per capita; others have nearly 2, the average being about one lamp. At present a fairly well developed town will average ½ to ⅔ of the stores and ¼ to ⅓ of the houses in town using electricity. And as these new lamps will give us such a competitive advantage that we can get nearly every store and every residence, think what a great opportunity is coming for the growth of our business. This means that other towns now too small can then support a plant. And in a small town the change from 200 customers, some dissatisfied, to 400 well-pleased ones, cannot fail to reduce the troubles and add to the profit and pleasure in the electric light business.

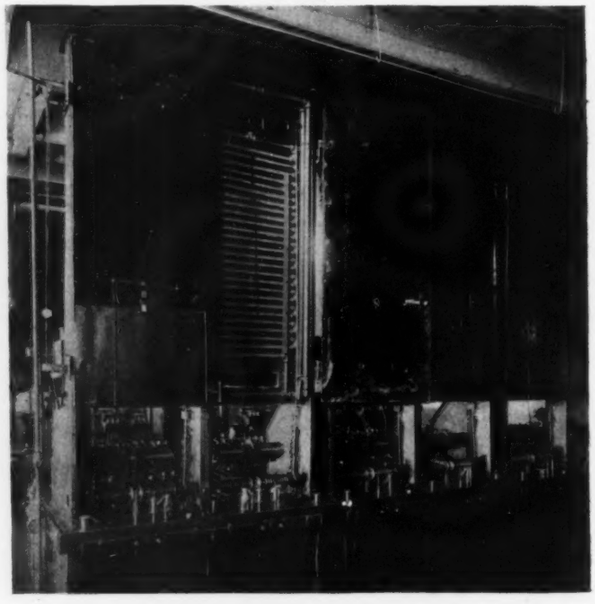
Enameled Wire.

Although the advantageous features of enameled wire have been known for many years, and such wire has often been used for certain special purposes, it is doubtful if the average reader knows that the wire is now being manufactured in large quantities and is finding general application in the construction of electrical machinery. The enamel which is placed on the wire occupies a comparatively small space for withstanding a certain voltage, and it is not affected by very high temperatures. Moreover, it is as flexible as the conducting material itself, and hence enameled wire can be handled as readily as can wire covered with cotton or silk. The wire is particularly advantageous for use where it is desirable that the space occupied by the insulation be as small as possible or where the apparatus may be subjected to high temperatures. It is used extensively for the windings of telephone magnets and for the moving elements of electrical measuring instruments. As a substitute for double-cotton-covered wire in dynamo-electric machinery its advantageous space factor has rendered it very desirable.

As an illustration of the special uses to which enameled wire is being put may be mentioned a certain variable-voltage generator constructed for direct connection to a constant-speed gas engine as the source of power for a self-contained electric railway car. The prime requisite for a satisfactory design was to obtain a maximum of output with a minimum of weight. The designers of the equipment were able to make use of the smallness of the dimensions of the insulated wire to decrease the size of the machine for operation at normal temperature, and the electrical characteristics of the machine were so arranged that it could carry what would be considered enormous overloads for a normal generator. That is to say, the machine was worked at what would have been a dangerously high temperature if cotton-covered wire had been used, but the temperature was not excessive for the enameled wire. The high temperature in itself is seldom objectionable in a dynamo-electric machine; the real trouble comes from the damage done to the insulation by the temperature. In the case of the present variable-voltage generator, by the use of enameled wire the machine is unusually light for its output, its weight being not greater than one-half of that of an ordinary generator of the same capacity and speed. It might be noted incidentally that the sparking difficulties were overcome by the use of commutating poles.

On account of the important place which enameled wire occupies in the electrical industries, it is believed that a description of the process of manufacture as carried out by the General Electric Company will be of interest at this time.

Before the wire is given its several separate coats of enamel it is thoroughly cleaned to remove all burs, and is polished to



ACETATE WIRE COATING MACHINE.

form a smooth cylindrical surface. The cleaning and polishing is a patented continuous process accomplished by causing the wire to be drawn from one reel, through a rubber hose containing sand, and to be collected on a second reel. A yielding pressure is maintained between the wire and the particles of sand by subjecting the external surface of the hose to compressed air which is contained in the space between the hose and an iron pipe by which it is surrounded. The wire emerges from the hose with a highly polished surface absolutely free from all irregularities.

After the above process the wire is given four separate layers of enamel, each of which is thoroughly dried at a high temperature before the succeeding layer is applied. In carrying out the coating and drying processes, the wire passes continuously from one reel, through the enameling machine, and is wound upon a second reel a finished product ready for immediate use. As the wire leaves the first reel it is carried over various sheaves which

cause it to dip into a long vessel containing enamel in a liquid state, then to pass upward and then downward through a space in which the temperature is automatically maintained constant at about 300° F. by means of gas flames controlled by thermostats. The speed of travel of the wire, the length within the heated space and the temperature are so adjusted according to the thickness of enamel that each particle is thoroughly baked when it passes downward, and the wire is dipped into a second enameling vessel, and so on until three coats of enamel have been placed on the wire. The fourth coat, which is an extremely thin one, is applied in the same manner and similarly dried, and gives an excellent finish to the product.

The accompanying illustration shows a group of enameling machines, each of which handles 12 wires simultaneously. The small space occupied by the insulation will be appreciated when it is known that a wire 5 mils in diameter measures only 5.5 mils in diameter when completely covered with enamel which has an insulating strength fully equal to that of silk which would give to the wire a total diameter of 7.5 mils. In order to equal the 5 mils of double-cotton covering on a No. 10 wire, 102 mils in diameter, the enamel would be only 1.5 mils thick. Thus the space occupied by the enameled wire will be 88 per cent of that taken by the double cotton-covered wire. Moreover, the enamel is not affected by moisture. The fact that the drying process is carried out at a temperature of more than 300° F. is conclusive proof that the enamel will not be injured by any temperature below this value.

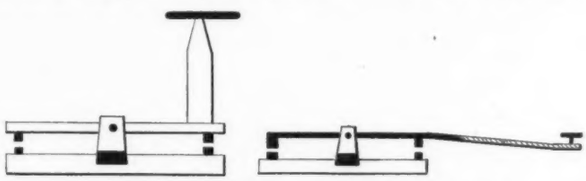
Arrangement of Wireless Telegraph Apparatus.

By D. McNicol.

Even casual inspection of the station wiring of aerograph offices indicates that it is time the scientists and physicists called to their assistance the services of telegraph men who have long since mastered the problems of convenient arrangement of apparatus controlled by the operator.

In present wireless installations it is customary to make extravagant use of large capacity knife switches for carrying currents a fraction of a milliampere; and these are generally located on the wall of the office quite a distance from the operating table, instead of being placed within reach of the operator. Likewise it is found that transmitting keys are used, which, although they are so constructed that the operator is protected against injury from shock, are not designed for accurate or rapid sending. The type of key frequently used is shown diagrammatically in Fig. 1.

This style of instrument will have to be discarded for the more practical key used in Morse telegraphy if any considerable volume of traffic is to be handled by the new method of telegraphy. The key used by De Forest and by Massie seems to meet the requirements in regard to insulation and still retain



FIGS. 1 AND 2.—FORMS OF TRANSMITTING KEYS.

the speed capabilities of the regular Morse key. As designed, the key, instead of keeping the operator's hand elevated two or three inches above the metallic connection, may have an insulating section extending horizontally instead of vertically (see Fig. 2).

In regard to placing the knife switches for the purpose of throwing the aerial from sending to receiving side of the system and vice versa, it is quite practicable to employ a regular four-point telegraph switch such as is used in duplex and quadruplex service, and this switch may be mounted on the operating table in a location convenient to the operator. Of course, the dimensions of the switch would have to be larger than the Morse switch in order that, when the transmitter is thrown in, there would be no possibility of sparking across to the receiving terminals. Another advantage of using the four-point switch is that one tuning coil serves for both transmitter and receptor.

Fig. 3 shows a wiring diagram of an aerograph office recently equipped by the writer, which is believed to possess cer-

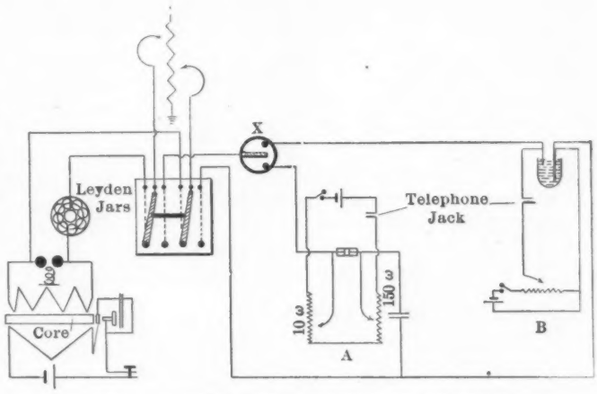


FIG. 3.—ARRANGEMENT OF STATION APPARATUS.

tain merits with reference to simplicity. The wiring provides that either of the receptors (*A*) or (*B*) may be thrown into service by simply moving the two-point switch (*X*) so that the aerial is in connection with the desired detector. The wiring of (*A*) is that best suited to microphone detectors and that of (*B*) to electrolytic detectors. Instead of having a phone receiver permanently connected to each detector, pin-jacks are connected into each separate receiving circuit and conveniently located so that one head phone serves for all, connection being made by simply inserting the double contact pin in the spring-jack of the operating detector circuit.

Another feature of the set described is the method employed to give a maximum spark discharge with a given discharge gap. This is accomplished by mounting a small isolated spiral of uninsulated copper wire 14 gauge, about sparking distance from the oscillator spheres, and in front of them at a point forming a triangle with the spheres. The efficiency of this attachment has been questioned, but it undoubtedly "fattens" the

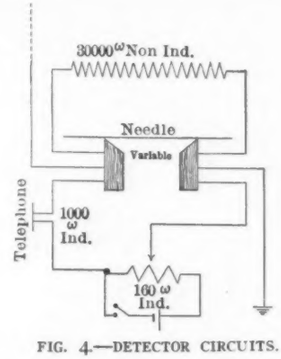


FIG. 4.—DETECTOR CIRCUITS.

spark. And where primary batteries are used, where mechanical interrupters are depended upon, and as long as oscillator spheres grow dirty, a spark "fattener" is a great help in prolonging workable conditions. Prof. Fessenden accomplishes practically the same thing by allowing the discharge to take place in a gas compressed to about twenty atmospheres. The wire spiral method, however, is simpler and much less expensive.

Still another improvement which is of value where detectors of the steel-carbon, or carborundum types are employed, is that

of controlling the maximum resistance of the detector by inserting a 30,000-ohm non-inductive path around the coherer as shown in Fig. 4.

Assuming that the minimum resistance is fairly constant when the receptor is affected by the intercepted train of waves, it is desirable also to provide a constant maximum in order that the signals reproduced in the telephone receiver shall have regular sounds.

While it is true that the intensity of sound in a telephone receiver is proportional to the square of the current variation it is evident that the character of the signals is most satisfactory where such current variation is under control and established within certain limits.

By referring to Fig. 4 it will be observed that there are three paths from aerial to ground: One through the detector directly, one inductive choking path through telephone receiver and potentiometer and one 30,000-ohm non-inductive path around the detector. The selection of 30,000-ohms for the latter path is to keep the resistance safely below that of the detector maximum. The laws of joint resistance enter to a certain extent, but not sufficiently to interfere with the satisfactory operation of the device.

The fact that the supply of thoroughly competent wireless-telegraph operators does not equal the demand for such assistance goes to show that the practical application of the art has reached that stage where standardization of equipment and connections would make it easier for the average Morse operator to do the work required.

Induction Potential Regulators.

By W. T. Fernandez.

Induction potential regulators are a type of transformer used in conjunction with polyphase rotary converter systems for the purpose of providing a method of variable control of the secondary voltage on the alternating-current side of the machines. The regulators consist of a stationary secondary winding within which a movable primary winding may be revolved in an arc of 180 electrical space degrees, or in other words, 90 electrical space degrees to the right or left of a center point.

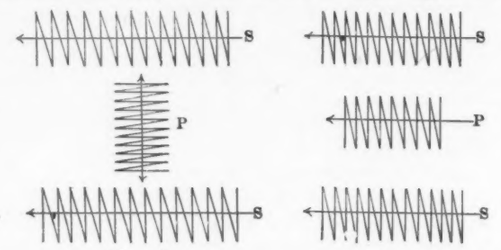
Motion is transmitted to the rotor, or movable winding from a small direct-current or an induction motor mounted on the top of the regulator, by suitable gearing which usually consists of a worm gear engaging in a rack called the quadrant which is attached to the rotor shaft. An automatic cut-out switch is provided at each end of the quadrant's travel which cuts off the current of the driving motor in that particular direction, but leaves the control circuit closed for a movement of the core in an opposite direction. Figs. 1 and 2 show two relative positions of the primary and secondary windings when they are arranged for "no boost" and for maximum "boost," respectively.

The troubles encountered with the motor and mechanical drive are the troubles common to such apparatus and will not be considered in this article. If the moving parts are kept properly lubricated and the coupling pins examined at intervals, very little trouble will develop in the above-mentioned parts of the regulator. While the principles involved in the induction motor and the induction regulator are the same, the speed of applying those principles is quite different.

In the induction motor, the primary or stator is stationary, and the secondary, or rotor, revolves, whereas in the induction regulator the reverse is the case and the rotor windings are excited from the secondary circuit instead of a purely inductive excitation as in the case of the induction motor. If the quadrant of a 150-kw regulator should be removed the rotor would revolve the same as in an induction motor and develop the mechanical power of its rating; but as the quadrant holds the rotor in a fixed position the power that would be developed, if the rotor were free, is produced in another way, and appears as additional voltage in the secondary windings, either in phase with or against the impressed e. m. f. of those windings, depending on the position of the rotor coils in their relation to the secondary coils; in other words, whether the rotor is in the maximum "boost" or minimum "boost" position.

A three or six-phase induction regulator is an intricate combination of electrical actions, but as it consists of three or six single-phase transformers, a clear idea of the principles involved and action of the apparatus may be obtained by considering a single-phase, rather than by attempting to follow the simultaneous action of the complete set of windings.

Fig. 1 illustrates the electrical arrangement of a single-phase regulator, in which are shown two secondary coils, *s s*, which are stationary, and one movable primary coil, *p*, in the center. In the position in which the primary coil is shown, it is evident that the magnetic lines of that coil are at right angles to those



FIGS. 1 AND 2.—POSITION OF THE PRIMARY AND SECONDARY WINDINGS.

of the secondary coils and therefore exert no influence on the secondary coils, or in other words, the primary coil is in the neutral position in its relation to the secondary coils.

Assuming a direct-current with a pressure of 125 volts, a rated rotary e. m. f. of 125 volts and a range of 20 volts, either way—that is, 20 volts "boost" and 20 volts "choke" by the regulator in its travel from maximum "boost" to minimum "boost" or "choke" position, as it is sometimes called, one can follow the graduations of regulation from one extreme to the other. Fig. 2 shows the primary coil turned 90 electrical space degrees from its former neutral position, or in the maximum "boost" position, thus bringing the primary and secondary polarities in line and impressing the 20 volts of the primary coil, thus adding that voltage to the secondary voltage and raising that voltage to 145 volts.

Moving the primary coil 180 electrical space degrees in the opposite direction reverses the condition and places the e. m. f.

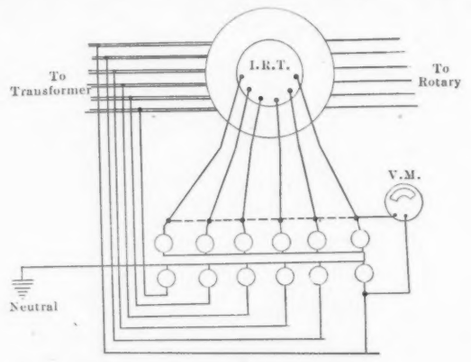


FIG. 3.—ARRANGEMENT OF LEADS.

of 20 volts of the primary coil in opposition to that of the secondary coils and reduces that voltage to that extent, by opposing a counter inductive e. m. f. to it.

It is obvious that when a rotary converter is running inverted that the maximum "boost" and minimum "boost" directions are reversed and the control switches should be operated accordingly.

The principal trouble in getting a regulator into service is the proper connecting of the primary leads, if the tags have been misplaced or lost. With the primary leads untagged a hundred or more combinations may be made on some types of regulators before the proper combination is attained.

Fig. 3 illustrates a method of picking the leads of a Westinghouse split secondary regulator. A lamp bank consisting of twelve 16-cp, 120-volt lamps is used; six lamps are connected to six respective cables from the transformers and the remaining six lamps connected to six respective primary leads, which have been disconnected from the secondary terminals of the regulator. The other sides of the twelve lamps are connected to a common wire, which is grounded, either to the neutral of the system or an artificial neutral provided for the purpose. The rotary may then be started from the direct-current bus under full field and with the starting box all in circuit. When the machine is running under the above conditions a test lamp or an alternating-current voltmeter is connected between a secondary terminal and each primary terminal in turn. The primary terminal which has the least difference of potential

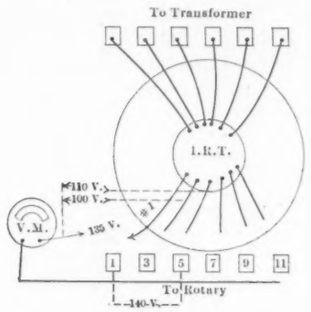


FIG. 4.—CONNECTION FOR TEST.

to the secondary mentioned, as indicated by the lamp or voltmeter, is the primary terminal which belongs in that particular secondary lug. Before the test is made the rotor of the regulator should be placed in either the maximum or minimum "boost" position, or in other words, at either end of its range.

With the Westinghouse straight-through secondary type of regulator, the primary leads consist of twelve leads instead of six, as in the split secondary type, and the two terminals of each of the six coils of the rotor winding are located by passing current through them in series with a test lamp, after they have been disconnected from the secondary lugs, and one set of six coil ends connected to the transformer side of the sec-

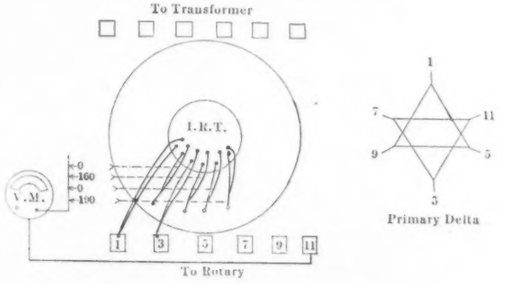


FIG. 5.—SELECTION OF LEADS.

ondary terminals of the apparatus. The machine is then started as in the former case the voltmeter readings taken between one phase of the secondary terminals on the rotary side of the regulator (Fig. 4). For example, if the voltage across one phase is 140 volts, one lead of the voltmeter is then connected to one outside secondary terminal, 11, and the other to each primary terminal in turn.

A different voltage will be obtained between each primary lead and the secondary terminal mentioned, but one particular primary lead will read from eight to twelve volts higher than any of the others, and within a few volts of the phase voltage; that primary lead should be connected to the other outside secondary terminal, 1.

The voltmeter lead is then transferred from terminal 1 to terminal 11, and the process of reading to each primary lead repeated. The lead which gives the highest reading should be connected to secondary terminal, 9, thus locating the first lead of each primary delta in its proper place. The voltage is then measured between each secondary and the primary leads in turn and the primary lead which gives the lowest reading—five or ten volts—to any particular secondary terminal, should be connected to that particular terminal. The entire test and connecting of the leads may be performed while the machine is running as directed. A slight spark may appear as the primary leads are inserted into the secondary lugs, but it is of no consequence.

The standard General Electric type of regulator may now be considered and as the primary leads of this apparatus are brought out of the rotor in the order in which they connect to the secondary lugs, there is rarely any difficulty in connecting the primary leads properly, but if such difficulty should be met with it may be overcome by starting the rotary in the manner previously mentioned, and then picking out each set of three leads which are connected together in the winding; in other words, a test lamp applied to each lead in turn will show that there are two sets of three leads, isolated from each other.

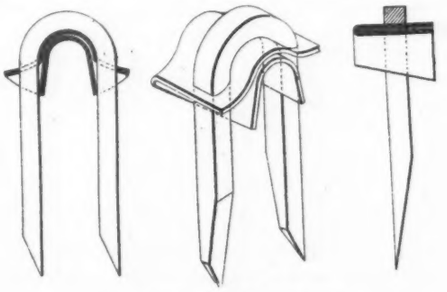
One lead of one delta is connected to the extreme left-hand secondary terminal, 1, and one lead of the second delta is connected to the adjacent secondary terminal, 3. Now, if a voltmeter is connected from secondary terminal, 11, to each of the disconnected primary terminals, it will be found that two zero and two voltage readings will be obtained, as for example, 0, 160, 0, 190. One of the primary leads which gives a zero reading belongs on the next secondary terminal, 5, the lead giving the lowest voltage reading on the next secondary terminal, the lead giving the second zero on terminal 9, and the lead giving the high reading on the last secondary terminal.

When leads are properly tagged the machine is shut down and the connections made as indicated; if when the machine is started again it appears to "buck" the primary, leads on 5 and the secondary terminals on 9 should be reversed.

The apparatus should be blown out with compressed air at regular intervals and moving parts kept well lubricated. A short-circuit in the regulator will, as a rule, set the insulation on fire, and the best method of handling that form of trouble is to cut off the current and apply water; it will not injure the apparatus and is quicker and more efficient than sand for such a purpose.

Insulating Saddle-Staple.

The accompanying illustration shows a type of insulating saddle-staple for which a patent was granted on February 12 to Mr. W. T. H. Taylor, Mr. W. J. Jenks and Mr. R. N. Dyer. The metal staple is provided with an insulating saddle composed of two thicknesses of relatively thin material formed of a



INSULATING SADDLE-STAPLE.

single piece folded upon itself. The upper fold is pierced by the legs of the staple, being thus held in place by friction, while the lower fold rests between the legs of the staple. The staple thus insulated is adapted to be made by automatic machinery.

Bell and Telephone Work in Fireproof Buildings.

By T. W. Poppe.

Bells and telephones are as necessary in modern buildings, especially institutions and large private residences, as electric lamps; and when conduit for the wires feeding the latter are being installed, conduit for the wires feeding the former are usually installed at the same time. The conduit for telephone wires is usually installed so that the public and private systems are kept separate.

For small call bell systems, the simplest method is to run a line of conduit containing the battery wires from the closet containing the battery to points where taps may be taken and continued in the most direct and convenient manner to the push buttons or bells. Fig. 1 shows a line of conduit connecting a battery closet in the cellar to an ordinary outlet box, and also branch lines running from the latter to other boxes. In each case a box is a receptacle for a bell or push button. In conduit *B*, the wires run direct from the battery to the outlet *C*. This need not be a special junction box. From the outlet *C* taps are run in conduit *T* from the battery wires and section wires between bells and push buttons may also be placed in conduit. From the outlet *C* a line of conduit *T R* carries the battery and such section wires as are required to get the desired combination of calls and signals. A section wire is one which continues the circuit from the push button to the bell, the other wires being known as bell and button wires.

When installing the conduit, the desired combination of calls should be known so that the proper conduits may be installed between the different outlets. Some conduits must of necessity contain more wires than others; hence the necessity of knowing the combination of calls desired, so that the proper number of wires may be installed. The system, once in place, is permanent and any changes will entail a large amount of trouble, in testing, removing insulation, etc. The system if properly installed, is free from trouble since there is no possibility of loose connections, breaks, etc., afterward.

A more flexible system may be had by installing at convenient points, interconnection boxes containing interconnecting strips. These are made of slate and have brass strips as long as the slate is wide and about ½ in. wide. They are drilled and tapped at each end for a No. 6/32 machine screw. Under these screws the wires are placed and fastened, the brass serving as the connector. Fig. 2 shows such an interconnecting strip. The bat-

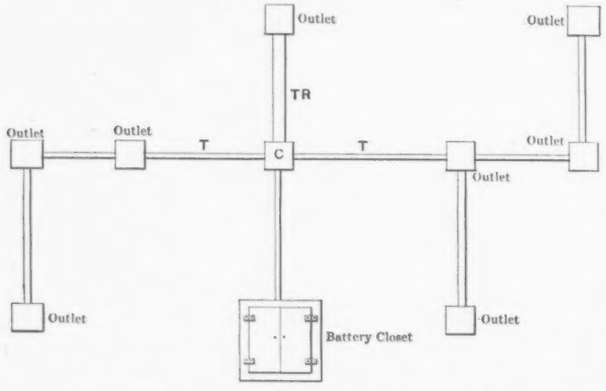
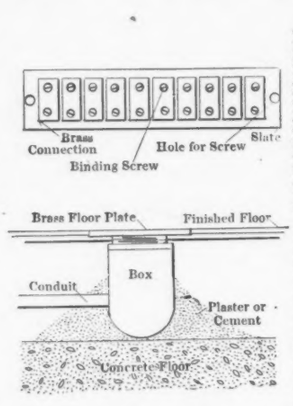


FIG. 1.—LINE CONDUIT CONNECTING A BATTERY CLOSET.

tery wires are brought to the interconnection box and lines of conduit run from the box to the various points where push buttons and bells are located. The necessary number of wires are drawn into each conduit from each station to the interconnection box and all connections are made by means of the binding screws on the strips. Fig. 4 shows an interconnection box in place and the conduits connected to it.

This system is especially valuable where annunciators are used as it permits of easy testing and changing of wires. It is good practice to run several spare wires from an interconnection box to the annunciator so that in case a wire is broken it will be unnecessary to withdraw all the wires to repair the one. This practice also avoids withdrawing the wire because of corrosion or breakage within the tube. This fault is liable to happen where dampness prevails and is often found in outlet boxes in the vicinity of defective plumbing. On the other hand should it be desired to connect new call stations to the annunciator it will be only necessary to run the conduit from the new station to the interconnection box and connect the wires from the new station to the spare ones in the conduit. This avoids having the annunciator out of commission while drawing new wires in the



FIGS. 2 AND 3.—INTERCONNECTING STRIP AND FLOOR BOX SET.

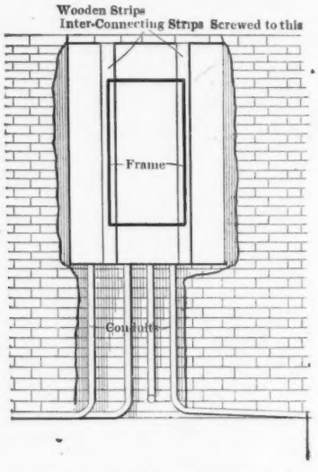


FIG. 4.—INTERCONNECTING BOX.

conduit, testing and identifying the wires and making new connections.

The conduit is fastened the same as for electric lighting. Where a bell is to be placed an ordinary outlet box is set flush with the wall, if the latter is plastered. If the wall is wainscoted the box can be set behind the wainscoting; a small hole being bored through the wainscoting for the insertion of the wires. The height of bell outlets is not fixed. A height generally used is from 8 ft. to 10 ft., but if a bell can be concealed so as not to interfere with the distribution of its sound when rung, it is a good plan to set it so.

Push buttons and bell switches are set, as a rule, 4 ft. above the finished floor. Push buttons are often placed on desks, and in this case an outlet box is set in the floor under the desk. From the floor box the wire is concealed in the interior of the desk and brought out at the push button. Fig. 3 shows a floor box set.

The interconnection box is set flush with the plaster or otherwise finished surface of the wall and is fastened by drilling holes in the brick work and driving in white pine plugs. The box is then fastened to the plugs. It might be necessary to cut out brick to set the box flush with the surface. If this is necessary the cavity surrounding the box should be filled with cement. This aids in holding the box secure.

An interconnection box should allow the connecting strips to set out from the rear of the box about 2 or 3 ins. Space is thus provided behind the connecting strips for the distribution and division of wires. Each wire should come from the rear and connect to the strip at the binding screw. No wires should cross the face of the strips.

The strip should be surrounded by a framework which will prevent the wires from being crowded over the edges of the outside strips. The trim of the door should allow the latter to cover only the space occupied by the strips. The space between the frame and inside of the box should be concealed by the wooden door frame of the trim. This applies both to bell and telephone work.

Outlets for a wall telephone set should be about 5 ft. from the

floor; an ordinary outlet box being used. The telephone set is then placed so as to conceal the box. Where desk telephone sets are desired a floor box (Fig. 4) is set flush with the finished floor. To the wires drawn into the conduit and box flexible wires are connected and concealed in the interior or about the exterior of the desk as much as possible and brought to the instrument.

The Telephone Repeater.

By Louis Cohen.

An examination of the literature on the telephone repeater will reveal the fact that the authors and inventors have apparently failed to appreciate all the factors that are involved in the problem. It appears that the inventors have directed their efforts in devising an instrument which shall reproduce and intensify the telephonic wave at some intermediary point on the line, irrespective as to what may be the condition of the wave when it reaches that point. Now this is not sufficient, and this is the reason why all telephone repeaters have uniformly disappointed the inventors. It would seem that the inventors of the telephone repeater were guided more or less by, what would seem, an analogous case—the telegraph repeater—but as a matter of fact there is no similarity between the two cases. In the telegraph line we are dealing with a single electrical impulse, and the main consideration in a repeater is merely the intensification of that impulse, while in the case of telephonic transmission we are dealing with waves of definite shape and period. In order that we may have clear articulation at the receiving end, it is essential that the waves sent out at the transmitting end shall preserve their shape, and so if we wish to intensify the telephonic current at some point on the line, we must first look out as to the condition of the wave when it reaches that point.

It is well known that in transmitting electrical periodic waves along a conductor, the velocity as well as the attenuation will depend on the frequency, and consequently the waves which are produced by the human voice and are complex in their nature will be distorted in traveling over a certain distance owing to the fact that the various harmonics will travel with different velocities and have different attenuation constances.

These facts can be probably brought out clearer by an elementary mathematical consideration. Let L, R, C, S, denote the inductance, resistance, capacity and leakage conductance of the line, all per unit length and let i denote the current at any point on the line; then the equation of propagation for the current will be

$$L\,C\,\frac{d^2 i}{d t^2} + (R\,C + L\,S)\,\frac{d i}{d t} + R\,S\,i = \frac{d^2 i}{d x^2} \qquad (1)$$

The solution of this equation is

$$i = A\,e^{-\alpha x}\,Sin\,(p t - b x) \qquad (2)$$

Where α is the attenuation constant and b is the velocity constant. Introducing the value of (i) from the equation (2) into equation (1) we get

$$A\,(-p^2 C L - \alpha^2 + b^2 + S R)\,e^{-\alpha x}\,Sin\,(p t - b x) + (2\alpha b - S L - C R)\,A\,e^{-\alpha x}\,Cos\,(p t - b x) = 0 \qquad (3)$$

Equating the coefficients of the sine and cosine functions separately to zero we obtain the following:

$$\left.\begin{aligned} -p^2 C L + S R - \alpha^2 + b^2 &= 0 \\ -p S L - p C R - 2\alpha b &= 0 \end{aligned}\right\} \qquad (4)$$

Solving for α and b from the above two equations we get:

$$\left.\begin{aligned} \alpha &= \frac{1}{\sqrt{2}}\sqrt{-p^2 C L + S R + \sqrt{(p^2 L C - S R)^2 + (p R C + p L S)^2}} \\ b &= \frac{1}{\sqrt{2}}\sqrt{p^2 C L - S R + \sqrt{(p^2 L C - S R)^2 + (p R C + p L S)^2}} \end{aligned}\right\} \qquad (5)$$

If λ is the wave length, then an inspection of equation (2) will show that

$$\lambda = \frac{2\pi}{b}$$

If T is the period of the impressed e. m. f., then denoting by v the volocity of propagation we shall have

$$v\,T = \lambda = \frac{2\pi}{b}$$

It is thus seen that the attenuation is a function of the frequency, and the velocity which is inversely proportional to b is also a function of the frequency. Hence, every harmonic of any particular wave will have a different attenuation constant, and will travel with a different velocity; and after the wave has traveled an appreciable distance along the lines there will be a shift in phase between the various harmonics which will produce distortion. As an example, consider the following case:

$L =$ .004 henry per mile
$R = 5$ ohms per mile
$C =$ .02 microfarads per mile
$S = 0$ (neglect leakage conductance)

Introducing the above values of the constants in equation (5) we get for $p = 3000$.

$$b = \frac{3.873 \times 10^{-3}}{\sqrt{2}},\quad \lambda = 230 \text{ miles},\quad v = \frac{3\sqrt{2} \times 10^{-5}}{3.873}\ \frac{\text{Miles}}{\text{sec.}}$$

For the second harmonic ($p = 6000$) we get

$$b = \frac{7.63 \times 10^{-3}}{\sqrt{2}},\quad \lambda = 117 \text{ miles},\quad v^1 = \frac{6\sqrt{2} \times 10^{-5}}{7.63}\ \frac{\text{miles}}{\text{sec.}}$$

$$\frac{v^1}{v} = 1.0152$$

The velocity of the second harmonic is about 1.5 per cent higher than that of the fundamental, and so after traveling a distance of 200 miles, say, the second harmonic will be about three miles in advance relative to the fundamental, or, in other words, the phase relation between the fundamental and second harmonic will be shifted by about 10 degrees. For the higher harmonics the effect will be still more marked.

Any repeater designed with the aim of merely reproducing and intensifying the wave as it reaches the repeater is sure to fail when tested on long lines, for even if a repeater could be designed that will reproduce exactly all the harmonics, it will still do nothing more than reproduce a distorted wave, and by the time the reproduced wave reaches the transmitting end it is still further distorted. In telephonic transmission it is not so much a question of intensity as of clearness.

Mr. Heaviside, Prof. Pupin and others, have repeatedly called attention to the fact that to have good telephonic transmission we must have constant attenuation and constant velocity for all telephonic frequencies, and to produce these results Prof. Pupin has invented his loaded line, which certainly does accomplish the desired result, and so far this seems to be the only means of getting good telephonic transmission. It is very doubtful as to whether a telephone repeater will ever be designed which will take the place of the loaded line as Prof. Trowbridge[1] seems to think.

Some inventors have to a greater or less extent considered the question of the variation of the attenuation constant with frequency, and some efforts have been made to overcome this difficulty, but they have lost sight of the other factor—the variation of velocity with frequency. Mr. D. M. Macl. Therrell[2], for example, has developed a very interesting scheme for intensifying the harmonics at the transmitting end which will to a great extent overcome the difficulty arising from the difference in attenuation of the various harmonics, but this is only curing half the evils; it does not eliminate or remedy in any way the distorting arising from the difference in the velocity of propagation of the various harmonics that enter into the composition of a telephonic wave.

[1] *Amer. Journal of Science*, 1906.
[2] Electrical World, June 30, 1906.

Tests for Determining Presence of Invention.

By John E. Brady.

In a previous article appearing in these columns it was stated that a patent cannot properly be granted protecting the product of mere mechanical skill as distinguished from invention. Difficulty is frequently experienced in distinguishing between the two, and the supreme test for determining whether a particular device is the result of mechanical skill is not whether an ordinary mechanic could make the device if it were suggested to him, but whether he would make it without suggestions save those which are prompted by his skill and knowledge of his art. For example, if a man constructs out of iron a machine which had previously been made out of wood, he does not thereby become an inventor in a legal sense, because everybody knows that any constructor can build a machine out of iron instead of wood. But, suppose that gunpowder had just recently been discovered and that the man who invented it had applied for and obtained a patent upon it. He might have claimed: "I combine saltpetre, sulphur and charcoal in a certain way, and produce a startling result," and it would be no answer, if an action for infringement were brought, for the infringer to say that every chemist could make the powder after he had been shown how. For, if every chemist did not have the knowledge as well as the skill, the originating of the powder constituted invention. Woodman vs. Stimpson, 3 Fisher's Patent Rep. 98.

There seems to be no general affirmative rule by which to determine the presence or absence of invention in every case. In fact, the term "invention" cannot be defined in such manner as to afford any substantial aid in ascertaining whether a particular device discloses an exercise of the inventive faculty or not. But there are a number of negative rules declaring certain circumstances under which an invention cannot be claimed, which have been adopted as guides by the courts, and each of these rules applies to a large number of cases.

It is deducible from the authorities that it is not invention, the subject being the same, to find a new position for an old device, unless there is a substantial difference in the manner of its operation and some new and useful result is produced. The new machine may be an unquestioned improvement upon the prior art and may supersede the old machine in the market; it may work faster and better in the new position and yield a larger product; nevertheless, if it be in fact the old machine, working substantially in the old way and producing substantially the same result, there is nothing upon which to predicate patentability. Thus, the placing of an electric burglar alarm on the outside of a safe instead of on the inside, as had been done long before the granting of the patent for the alleged invention, did not require invention, but disclosed mechanical skill merely and the device in the new position was not patentable. Holmes Electric Protection Company vs. Metropolitan Burglar Alarm Company, 33 Fed. Rep. 254.

It is no invention to use an old machine for a new process. The inventor of a machine is entitled to all the uses to which it can be put, including uses of which he had conceived no idea at the time of his invention. Roberts vs. Ryer, 91 U. S. 150. Parallel with this rule is the doctrine that the application of an old process to a new and analogous purpose does not involve invention, even though the new result had not before been contemplated. To illustrate: In 1883 a patent was issued to Alfred A. Cowles for an "insulated electric conductor" and a number of years later a subsequent owner of the right to use the patented insulator brought an action to restrain what was considered an infringement. Paraphrasing the language of the court, it seems that, although the art of insulating electric wires is almost as old as the art of conducting electricity for practical purposes by means of wires, it was not until electricity began to be used for lighting purposes that it became necessary that insulating material should be non-combustible. The result of the introduction of electricity for lighting purposes was that the insulating material then in use was frequently melted or set on fire and conflagrations from this cause became so common that insurance companies refused to issue policies on buildings in which the usual method of insulating wires was employed. Mr. Cowles was the first to discover that paint was the required insulator, it being practically non-combustible, and he accordingly applied for and obtained a patent upon his new process, which consisted of applying a coat of paint to a wire covered with cotton braid and then applying a second braiding directly upon the fresh paint so as to force the paint into the first braided covering and render it non-inflammable. It appeared at the trial that Edwin Holmes, referred to by the court as the "manufacturer of an electric burglar alarm," as early as 1860, had begun to cover his wires by a process similar to that of Cowles, the only difference lying in the fact that he allowed the paint to dry before putting on the second covering of braid. At that time there was no necessity for a non-combustible insulation and Holmes stated that it had not been his idea to produce such a one and that his method was no better adapted for electric light conduction than the paraffine-coated wire. It was held, however, that Cowles had done nothing more than apply an old process to a new and analogous purpose and that, for that reason, the patent which he had been granted was void. Ansonia Brass & Copper Company vs. Electrical Supply Company, 144 U. S. 11.

As a general rule, a change in the size of a machine or the parts thereof does not constitute invention, but is classed with the output of mechanical skill. It is a rule, however, which, like most other rules of law, has its exceptions. In the Edison Electric light patent, granted in 1880, the one difference between Edison's carbon filament and the earlier carbon burners of Sawyer and Man was that Edison had reduced the diameter of his filament to one-half the value of those previously made. But this reduction increased the resistance of the burner four-fold and reduced its radiating surface two-fold, thus increasing the ratio of resistance to radiating surface eight-fold. "That eight-fold increase of proportion," says Walker, in his work on the law of patents, p. 29, "enabled the resistance of the conductor of electricity from the generator to the burner, to be increased eight-fold, without any increase of percentage of loss of energy in the conductor, or decrease of percentage of development of heat in the burner; and thus enabled the area of the cross-section of that conductor to be reduced eight-fold, and thus to be made with one-eighth of the amount of copper or other metal which would be required" if the reduction of diameter of the burner had not been made. Former carbons had been found not to possess lasting qualities. While carbon burners continued to break down, even after Edison's invention, still the improvement which he made caused them to be more stable than they had ever been before. The device was held to have displayed inventiveness, the court remarking in the course of its opinion, that the difference between carbons that lasted one hour and carbons that lasted hundreds of hours was precisely the difference between failure and success. Edison Electric Light Company vs. U. S. Electric Lighting Company, 52 Fed. Rep. 300.

In passing upon the question of the presence of invention, simplicity in the appearance of the device is immaterial. The proposition is illustrated in the case of Colgate vs. The Western Union Telegraph Company, 15 Blatch. 365, which was an action founded upon letters patent granted to George B. Simpson in May, 1867, as inventor of "an improvement in insulating submarine cables." In the opinion is an interesting outline of the efforts of the inventor to obtain a patent for his invention, which covered a period of nearly twenty years, the first application being made in January, 1848, and the letters being finally issued in May, 1867. The claim of the patent was "the combination of gutta percha and metallic wire, in such form as to encase a wire or wires, or other conductors of electricity, within the non-conducting substance, gutta percha, making a submarine telegraph cable, at once flexible and convenient." It was admitted by the defendant company that it had used submarine cables, in the insulation of which gutta percha was employed, but it was contended as a defense that it had long been known that resins and gums, as a genus of articles, were electric

insulators, and that, therefore, it did not require invention, when gutta percha became known, to cover wire with it for the purpose of insulating the wire. But it was held that there was invention in the discovery of the fact that gutta percha was a non-conductor particularly suitable for submarine cables. It was very easy, after the discovery had been made, to say that it was a natural conclusion that gutta percha would be an insulator from the known insulating properties of gums and resins generally. But it was also a fact that experienced men had groped about, experimenting first with one device and then with another, in fruitless effort to secure a practical means of crossing watercourses with lines of telegraph wires, until it was at length found that gutta percha was the needed insulator.

Frequency Changers.

By J. P. Jollyman.

IT is proposed to consider some of the operating features of 60 to 25, or 25 to 60-cycle synchronous frequency changers. Since the highest speed possible for such sets is 300 r.p.m., which speed is low enough for any likely to be used at the present, sets of this speed only will be considered. Most of the data given were derived from the operation of two 4000-kw sets having no starting motors. Values given will undoubtedly vary with machines of different sizes and design, but the general conclusions should apply in any case.

Such sets have 24 poles on the 60, and 10 on the 25-cycle side. The sets are started by applying half voltage from suitable transformer taps to the armature of either machine, the field circuit of which must be open. This is amply sufficient to start a set and bring it to full synchronous speed in a little over one minute. About the full-load current of the machine at a low power factor is required from the line to start. When the set drops into synchronous speed, the line current drops to about one-third full-load value.

The motors may drop into synchronism on any pole; hence when the field current is applied, the armature current may immediately drop, if the polarity of the poles due to the field current is the same as that induced in them by the lagging armature currents, or may momentarily rise if the opposite is the case and the motor is forced to drop back a pole. Reversing switches should be provided in the motor field circuit to avoid this needless rise in current. In operation, a mere touch of the field switch to its jaws is sufficient to determine whether or not the polarity is correct. These switches are especially necessary if the full voltage is applied to the armature before putting on the field.

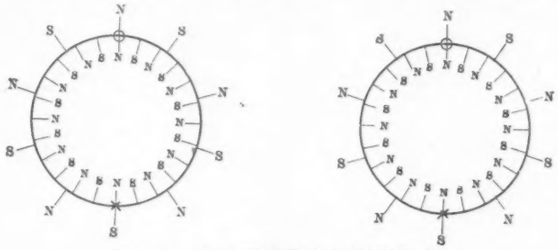
A better way than passing to full voltage before applying the field is to close the field circuit while the half-voltage taps are still connected to the armature. The field current should then be raised to a point between that necessary for half and for full voltage on the armature, and then with a double-throw switch, the motor can be transferred to the full voltage taps. With high-voltage motors of large size, two single-throw oil switches may be found more suitable than a double-throw switch, and then it may be found preferable on account of the slow action of such switches, to allow the motor to drop back one period and then apply the full voltage.

It has been shown that a set of this speed can be paralleled on both sides with a like set only once during one revolution of one set with respect to the other. Hence there is only one chance in twelve that the sets will be in step on the 25-cycle side when starting a second set from the 60-cycle side; or one chance in five when starting from the 25. Starting with the two sets in parallel on both sides, the 25-cycle machines will be $-150°$, $+60°$, $-90°$, $+120°$, $-30°$, $\pm 180°$, $+30°$, $-120°$, $+90°$, $-60°$, and $+150°$ apart when the 60-cycle motors are together on successive pairs of poles as one set is dropped back one period at a time. The signs indicate the position of the armature of the machine dropping back; (+) being "Fast" on the synchronizer and (—) being "Slow." The corresponding phase displacement on the 60-cycle side are $-144°$, $+72°$, $-72°$ and $+144°$ as the 25-cycle machine is dropped back.

It will be seen that when using the 60-cycle sides as motors, the 25 may be brought together on the sixth period, when they are $\pm 180°$ apart, by reversing the field of the incoming machine. No such result can be obtained when using the 25-cycle sides as motors. When about to parallel one set with another on both sides, the field may therefore be in either direction on the 25-cycle sides, but the fields of the 60-cycle sides must be alike.

This may also be shown graphically. The outer positions in the accompanying figures represent the pole of the 25-cycle and the inner, those of the 60-cycle ends. Fig. 1 represents set No. 1 with the two field winding similarly arranged. Fig. 2 represents set No. 2 with the two field winding similarly arranged. It is apparent that if the 25-cycle field coils of No. 2 be reversed the point x will become the same as O had been, in that north poles on both machines will be together, and the sets may be paralleled when x, Fig. 2, is opposite O, Fig. 1. If, however, the 60-cycle side of No. 2 be reversed, there can no longer be any point on set No. 2 where a north pole on the 60-cycle side will be in line with a north pole on the 25-cycle side; and this is the condition which must obtain before the sets can be paralleled.

It is found that when one set is loaded, and a second set brought up from the 60-cycle side, a phase displacement of



FIGS. 1 AND 2.—POLE ARRANGEMENTS.

about 25 electrical space degrees exists between the e. m. f. of the loaded and that of the empty machine, due to the dragging effect of the load which, in the case under consideration, was practically non-inductive. It is, therefore, necessary to make an allowance proportional to the load and to parallel the 25-cycle side when the synchronism indicator shows the incoming machine to be from 0 to 25° "Fast," depending on the load. Inasmuch as the 25-cycle side is only $-30°$ apart at one position of the 60-cycle, it is possible to parallel in such a position that the incoming machine will be 30° behind its proper position and will not take its share of the load. The two sets will then divide the load thus: About 1¼ times the full load on the set first in service and nothing on the other. Should the total load drop below 25 per cent overload for one set, the first set would transmit power into the second and a reversal of the functions of the machines of the second set would occur. Such a condition could be used in making a pumping back test on two sets.

With the correct position secured before putting the sets together, the sets divide the load exactly and no special adjustments of the fields of either set are necessary, either before or after paralleling. When once in parallel, the load cannot be shifted appreciably by changing any or all of the fields, even though one field be made nearly twice that of the corresponding field on the other set.

A mechanical change of the position of the armature of one of the machines of one of the sets with respect to the corresponding armature of the other would cause a change in the relative loads. Such a device offers the only means of gradually shifting the load from one set to another.

The two frequency changer sets above referred to were installed by the California Gas & Elec. Corporation at San Francisco, Calif., in order to supply power from the transmission lines to the United Railroads of San Francisco. The sets have been in operation a year very successfully. The capacity of each set is 4000 kw.

Brush Holders and Brushes for 500-Volt Motors—I.

By Eugene C. Parham.

The motors used in railway repair shops for driving machines, usually through the agency of shafting, are of two kinds—stationary motors, presumably adapted to the work in hand, and discarded railway motors of the ordinary type, but shunt-wound to give fairly constant speed at variable load. Both kinds have sparking troubles as the result of irregularities, some of which are common to both and some of which are not. With comparative brevity, we will consider troubles incident to abuse or neglect or poor design of the brush-holders or improper care or selection of brushes or bad condition of the commutator.

Assuming all other conditions to be correct, as will be indicated elsewhere in this article, it is vitally essential that the holder space the brushes or sets of brushes the right distance apart along the circumference of the commutator. On a two-pole motor this condition is fulfilled when a straight line through the center of the commutator is symmetrical with respect to the contact surfaces of the two sets of brushes; in other words, when the two sets of brushes are directly opposite each other.

The test for this condition is to count from the center of bearing surface of one set to the center of bearing surface of the other set, and in both directions. If the count in both directions is the same, the set is correct. Instead of counting between the centers, which is sometimes very inconvenient, it is customary to count between inside edges as indicated at *a* and *b* in Fig. 1; the count between inside edges will be less than the count between centers by an amount equal to the number of commutator bars spanned by the thickness of one brush (two half brushes). Thus, if the commutator outlined in Fig. 1 has 105 bars and the thickness of a brush spans two bars the count between centers will be $105/2 = 52\frac{1}{2}$ bars, but the count between adjacent edges will be two bars less than this or $50\frac{1}{2}$ bars. As a rule, it is sufficient to know that count *a* is the same as count *b* without knowing the absolute number of bars in each count. Where there are four sets of brushes the count from the center of one set to the center of the next should be one-fourth the total number of bars in the commutator; in the case of six sets of brushes, one-sixth the total number of bars in the commutator, and so on. In any case, to get the count from center to center, divide the total number of bars by the number of sets of brushes; to get the count between inside edges, subtract from this the number of bars spanned by one brush. Strictly speaking, wherever the word "bars" has been used in the preceding it would be more correct to use the word "units," a unit being one bar plus one mica body. The error in failing to make this distinction, however, is less than the error ordinarily made in counting off a new commutator and then a worn one of exactly the same kind and can be neglected.

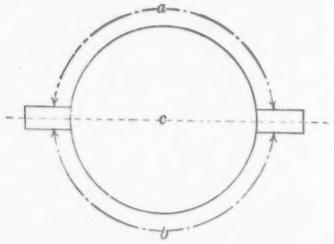


FIG. 1.—BRUSHES ON TWO-POLE MOTOR.

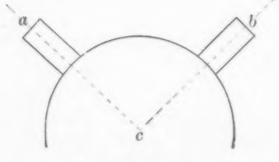


FIG. 2.—RADIAL BRUSHES.

A radial brush is one intended to be so presented to the commutator that the long center line of the brush passes through the center of the commutator; thus in Fig. 2, *a* and *b* are radial brushes, lines *ac* and *bc* being their respective long center lines. A holder for radial brushes is called the radial brush holder, the name radial in both cases being due to the fact of the axis of the brush and holder pointing along a radius of the commutator. A glance at Fig. 2 shows that if the brush holder maintains a strictly radial position the set of brushes will remain unchanged throughout the wear of the commutator, because since the angle of the axes remains the same, the proportion of the commutator between the brush centers must also remain the same; but the count between the inside edges will not, because, as the commutator gets smaller from wear, the commutator-bars become thinner so that the number of commutator-bars spanned by the thickness of a brush becomes greater; this means practically that although the brush set on new and old commutators of exactly the same kind may be exactly the same the count between inside edges will not be the same. In other words, if a motor with stationary brushes comes from the factory with the brushes set correctly and a jig be made according to this set, proper use of this jig will insure correct set of subsequent holders, but in checking by a count, allowance must be made for the size of the commutator under test. On this account data to be used in making a brush setting jig should never be taken from an inside edge count, but from a center to center count, if a count is to be used at all.

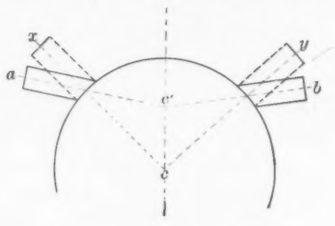


FIG. 3.—BEVELED BRUSHES.

As the motors used in railway repair shops operate from 500-volt circuits and the currents used are small as compared to the currents taken by motors of the same rating, but of low voltage, carbon brushes are used and these are often of the strictly radial type of Fig. 2; just as often, however, to get increase of carrying capacity at the bearing surface without increasing the cross-section of the brush, the brush is beveled on the end, thereby requiring that the brush be presented to the commutator in the manner of Fig. 3, which is exaggerated to show the idea more clearly; such a brush, with its containing holder, is not strictly radial, because the axis of neither is continuous with any radius of commutator. Such a brush might be called a modified form of radial brush because although the brush, as a whole, does not move in radially with commutator or wear, its contact surface does and the holder must be constructed to fulfill this condition. If the contact surface of the brush be considered as one of the short sides of a rectangle, as indicated in Fig. 3, then the long axis of this rectangle must pass through the center of the commutator, as indicated by lines *cx* and *cy*. In other words, the bearing surface of the brush must be at right angles to the radius that touches it at its center. Nearly all forms of copper brushes come under the head of modified radial. As will be shown later, failure to fulfill the conditions of radiality wherever they occur, will result in error in the set of the brushes.

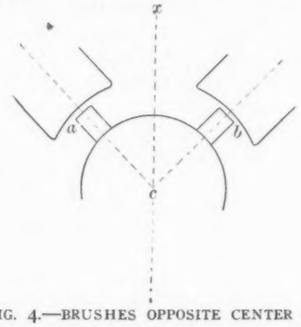


FIG. 4.—BRUSHES OPPOSITE CENTER OF ADJACENT POLE PIECES.

To avoid sparking, the holders must, irrespective of the kind

of holder used, hold the brushes at the neutral points. On motors that must normally operate, without preparation, equally well in both directions, the brush-holders are stationary and

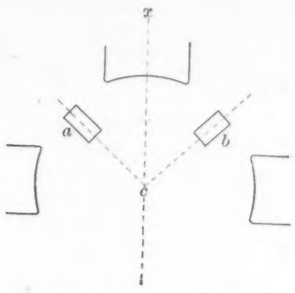


FIG. 5.—BRUSHES OPPOSITE CENTERS OF ADJACENT SPACES.

their correct position must be secured once for all in the first place. On holders not ordinarily intended to operate in both directions without any changes, the holders are adjustable by means of a rocker arm and the non-sparking positions can be located by trial, provided the holder is correct in all other respects. Considering holders of the stationary type in relation to a four-pole motor, for example, the non-sparking points at which the brushes must be held will be directly opposite either the centers of two adjacent pole pieces, as in Fig. 4, or opposite the centers of the spaces on the two sides of a pole piece, as in Fig. 5, the former condition being sometimes dictated by the necessity of having the brush holders on top where they are accessible for repair or renewal purposes. Either of these figures show that it is not sufficient for the holder to hold the brushes the right number of bars apart, but, assuming the motor to rest level and a line through the brush holder to be horizontal, the brushes must be symmetrically placed in respect to a vertical line passing through the center of the commutator; in other words, in the case of a four-pole motor, it is not sufficient that the axes of the brushes or of the contact rectangles, in the case of the modified radial brushes, make a right angle, the apex of which is at the center of the commutator, but the angles that the axes make with the vertical reference line must be equal; angle *acx* must equal angle *bcx*. If these angles are not equal, the motor will run all right in one direction, but will spark when operated in the other direction.

This point is well illustrated in the case of holders that have an adjustable rocker arm; the holders may be such as to space the brushes exactly the right number of bars apart, but if the rocker arm be shoved too far forward, thereby moving both holders bodily away from the neutral positions, the brushes will spark. Where a motor has more than four poles, the same requirements obtain in principle, but the angle that the axes make is different. In any case the angle that the axes should make with each other can be obtained by dividing 360 degrees by the number of sets of brushes. On some motors of the railway type, the commutator hand-hole is placed on the slant so that the brushes can be renewed from under the car instead of through trap doors in the car floor. In this case the armature connections are such as to bring the holders over to conform to the position of the hand-hole; then the line of symmetry will not be vertical, but makes a definite angle with the vertical.

The requirements of a brush holder, then, so far as correct spacing of the brushes is concerned, are that the brush axes or brush contact axes, according as the brushes may be strictly radial or modified radial, must make with each other a certain angle the apex of which is at the center of the commutator and, in the case of stationary holders, the axes must make equal angles with a line of symmetry. If a line passing through the brush holder studs or stud bolts is horizontal, thereby indicating the brush holder as a whole to be horizontal, then the line of reference is a vertical line passing through the center of the commutator; but if the brush holder as a whole, for reasons of inspection, rests at an angle with the horizontal, then will the line of symmetry make a certain angle with the vertical line.

Holders as they come from the factory on the motor are generally, but not always, correct. It is, as a rule, when it becomes necessary to replace some worn, burnt or distorted part that the trouble with brush setting begins. If repair parts are ordered from the original maker, the chances are that they will be as correct as those shipped with the machine; where an effort is made to construct in the home shop or the repair parts are ordered from an outside shop that probably has never made the part before, the probabilities are that the man who must use the brush holder has some experiences ahead of him.

The Regulation of Boiler Feeders—II.

By Charles S. Towne.

Fig. 9 illustrates a regulator for a boiler feeder that resembles a water column without trimmings, although a glass gauge might easily be attached and would be convenient to show the

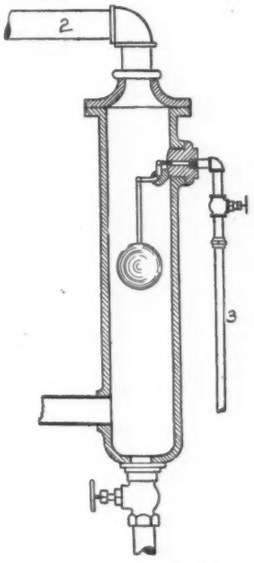


FIG. 9.—BOILER FEED REGULATOR.

water level at all times. Engineers sometimes omit all such fixtures as far as possible in order to avoid not only the first cost of them, but the trouble of caring for them in every-day practice. Under some conditions this may be the best plan to

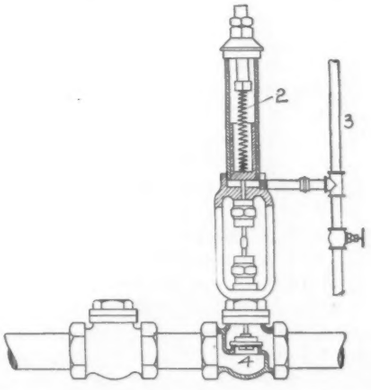


FIG. 10.—SECTIONAL ELEVATION OF REGULATOR.

follow, but where the appliances are to be under the immediate care of the engineer, the extra trouble caused is more than repaid by the satisfaction of having a complete plant to operate. This is the true spirit of successful steam engineering.

This regulator chamber contains a float that operates a needle

valve by means of a bell crank lever. When the water level is low enough to allow the float to hang in its lowest position, the valve is wide open, allowing steam to flow through the upper connection, 2, and out of the vertical pipe, 3, where it operates to open the feed valve and allows water to flow into the boiler. When the water level is raised enough to carry the float, the needle valve is closed, thus preventing steam from entering 3, the result of which is that the feed valve is shut and remains closed until more water is wanted. This action will be better understood by examination of Fig. 10. When water is not wanted, the spring 2 keeps the feed water valve closed, but when steam enters 3 it is conducted to a small cylinder containing a piston on which the steam acts, thus forcing it upward against the spring. As this piston is connected to the valve, 4, by a suitable rod, they both rise together, and when steam is shut off from 3 the piston and the valve are forced downward by the spring.

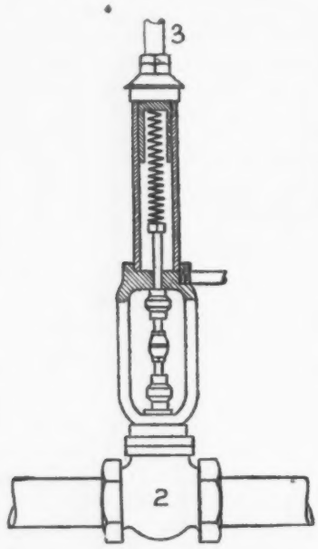


FIG. 11.—AUTOMATIC PUMP PRESSURE GOVERNOR.

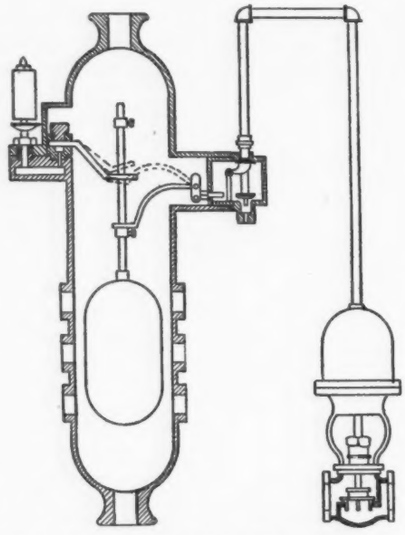


FIG. 12.—COMBINED REGULATOR AND HIGH AND LOW WATER ALARMS.

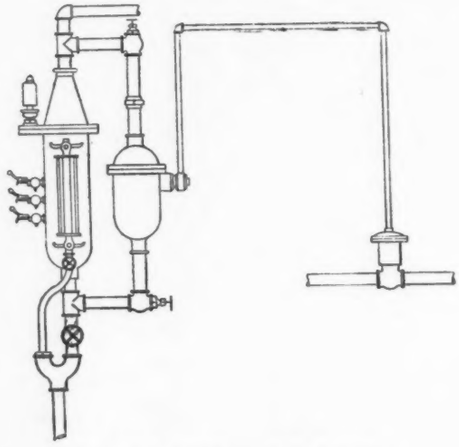


FIG. 13.—INDEPENDENT REGULATOR.

Fig. 11 illustrates an automatic pump pressure governor to be used in connection with the foregoing regulator. Steam to operate the pump passes through the valve, 2, and the pipe, 3, is connected into the feed pipe about 10 ft. from the governor. Under ordinary conditions the spring shown holds the small piston in the upper part of the cylinder, but when the tension of this spring is overcome by pressure from the feed pipe it is forced downward and the valve is closed. This governor is to be used in connection with either one boiler or a battery, according to requirements. In all such cases where more than one is to be controlled, care must be taken to connect the upper pipe, 3, where it will always be under pressure regardless of the number of boilers in use. If it is connected into the separate feed pipe of either, there will come a time when that boiler will be laid off, while the others are wanted, thus rendering the governor useless at a most inconvenient time.

Fig. 12 illustrates a feed-water regulator combined with a high and low-water safety water column designed to maintain a water level at the opening for the second gauge cock, and to blow a whistle if for any reason it falls to the first or rises to the third. The hollow copper float is fitted with a straight stem carrying two adjustable collars that engage the levers shown. One at the right opens and closes a valve that admits steam to the feed water valve, the upper part of which contains a diaphragm by means of which a large surface is exposed to steam pressure, thus providing great force to close the regulator valve. Nothing special is required to open it as water enters under the disk, which, of course, tends to raise it, but when the supply of water is to be shut off the valve must be closed against the feed water pressure. When the valve is wide open, it is practically balanced, excepting the force exerted by the moving water; but when it is nearly closed more force is required because the pump will create more pressure under the disk than acts on top of it before the pump governor will shut off steam from the steam chest and cylinder. For the same reason the valve disk will lift readily without a special external device.

Where a boiler is not fitted with a safety water column of some kind, so that an alarm will be sounded whenever the water level approaches the danger limit in either direction, it should be so equipped without delay; therefore if a feed water regulator is combined with the column, the extra expense of each is not heavy. If a safety column is already in use, an independent regulator can be added with little trouble. Fig. 13 illustrates such a device in operation. All pipe connections should be of ample size in order to insure the same water level in the regulator that exists in the safety water column. Pipe that is 1¼ in. in diameter is sufficient for all ordinary purposes.

Connecting Up Valves.

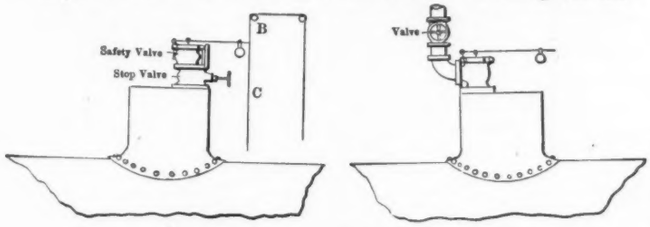
By Wm. Kavanagh.

The proper placing of valves on boilers and engines is an important function, not only from the viewpoint of continuous running, but also to insure safety to the men in charge of steam power plants. Too little attention is given to this important detail, which certainly does not receive the amount of thought and discussion that is given to the engine, boiler or pump. The following will serve to show some incorrect connections met with in practice, and the means by which they can be eliminated.

Fig. 1 illustrates a very serious mistake that should never be permitted. A stop valve is connected between the dome and the safety valve, and whenever the engineer meets a connection like this he should remove the disk from the stop valve as this is generally easier to do than to remove the valve. Another contrivance is shown at *B*. Here there is a chain or string attached to the lever of the safety valve, the string running over the pulleys being used to raise the lever and weight occasionally while the other string at *C* is for the purpose of holding down the lever whenever the safety valve leaks or shows a tendency to make a noise. The string for raising the lever is good practice, but the string for holding down the lever should not be countenanced.

Fig. 2 shows a stop valve connected on the safety valve exhaust or waste pipe. This, to say the least, is very bad practice because the stop valve may be closed when the safety valve opens, thus preventing the safety valve from relieving the boiler of excessive pressure. Whenever a stop valve is found connected in this manner it should be removed, but if its removal involves much labor the next best thing to do is to take out the valve disc, which will prevent overpressure and attendant danger. If the safety valve leaks it should be ground in, which grinding, if properly done, will make the valve tight, thereby preventing unnecessary waste of steam.

Fig. 6 shows a water column connected to a boiler. It will be seen that with this method of connection four valves are used between the column and boiler. The valves *A* and *D* are emergency valves and the valves *B* and *C* are used for cutting out the column for repairs. Should valves *B* and *C* leak the necessary repairs will be difficult to make, but when the column is fitted with the extra valves, *A* and *D*, these can be closed, thus facilitating repairs. The valves *C* and *D* should be gate valves, and the connection at *E* cross fitted with a brass plug, as shown. Whenever the connection between *E* and the boiler lime up or become filled with scale the plug can be removed when the boiler is cool and a long drill inserted through the connection and valves and the pipe thus cleared of all foreign matter. If a carpenter's brace be attached to the drill, it will assist materially in cleaning out the



FIGS. 1 AND 2.—POOR VALVE CONNECTIONS.

connection. If the valves, *D* and *C*, are of the globe pattern the drill cannot be used. It is almost unnecessary to mention that this is an important connection and that the scaling up of the valves and nipples will result in showing false water.

Fig. 3 shows a feed pipe connected partly below the water line. The pipe is perforated and open at its end and extends well back towards the rear head. Two valves (gate or globe) and one check are fitted as shown at *A*, *B* and *C*. The valve, *A*, is an emergency valve which can be closed whenever *B* needs a new disk or regrinding; valve *B* being used oftener than *A* is more liable to get out of order, hence *A* is a very useful and reliable addition especially if check *C* leaks and is in need of repair. The usual style of connecting the feed pipe to a boiler is shown at *F*. It will be seen with this method

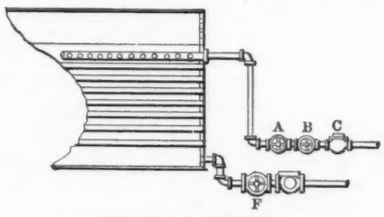


FIG. 3.—FEED PIPE.

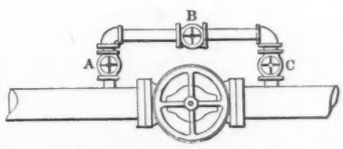


FIG. 4.—STOP-VALVE.

of connection, repairs to the check are impossible as long as the globe valve leaks; besides the feed water being discharged close to the crown sheets induces unequal expansion, which is not desirable.

Fig. 5 shows an improved method of connecting up a blow-off. The blow-off pipe is flanged to the rear fire sheet of the boiler shell and extends out through the rear wall of the boiler setting. A tee is connected at *A* for the purpose of connecting up a pipe so as to induce or set up a circulation, thus preventing the pipe from becoming filled with scale. A further precaution is adopted by covering that portion of the blow-off which is subjected to the heated gases with asbestos or some other material that is difficult for the heat to destroy. Valve *B* is the blow-off and *E* is an emergency valve. With valve *B* shut one can tell the amount of leakage in it by opening drip *D*. Should *B* leak, *E* can be closed and of course *B* can be repaired, when the boiler is shut down for cleaning or inspection.

If valve *E* leaks and *B* is fairly tight, the former can be repaired, which will prevent loss in this direction. The old style of fitting the blow-off with one valve or a single asbestos packed cock is a poor one and is not reliable.

When high pressure steam is carried on the boilers or steam mains all large valves should be by-passed. Fig. 4 illustrates a large stop-valve by-passed; the by-pass is fitted with three valves, *A*, *B*, *C*. *B* is an emergency valve and can be repaired, providing *A* or *C* does not leak too badly. The old style of by-pass was fitted with the valve *B*. The fitting of the by-pass with one valve prohibited its repair unless steam was shut off from the main or boiler. The addition of valves *A* and *C* makes the by-pass more secure and eliminates leakage. Why large valves should be by-passed can be seen from the following example: Assuming the stop valve is six inches

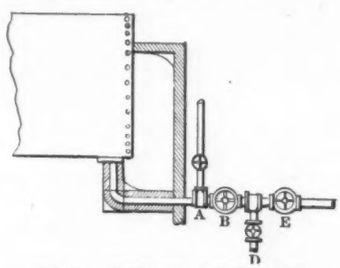


FIG. 5.—BLOW-OFF CONNECTION.

in diameter and tight under a pressure of 200 lbs., then the load against which the valve must be opened is equal to $3^2 \times 3.1416 \times$ pressure $=$ 5654.88-pounds of a load. In order for a man to open a 6-inch valve under this load he must use some kind of a lever and should the valve stick there is a liability of stripping the threads off the valve stem or twisting off the wheel; hence if the valve was by-passed and the attendant knew how to use it such accidents would be impossible. The opening of a large or medium size valve under high pressure is a dangerous operation. The valve should be opened slowly; a sudden opening of the valve is very liable to cause a rupture in the main, therefore great caution is absolutely necessary.

Fig. 7 shows how the stop and throttle are by-passed on an engine. When an engine is fitted up in this way the by-pass

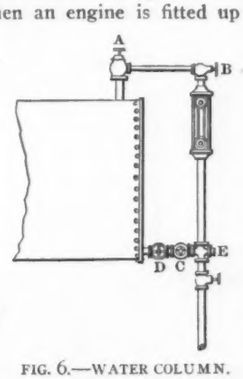


FIG. 6.—WATER COLUMN.

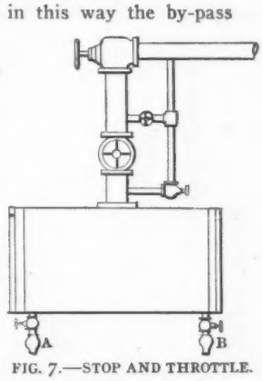


FIG. 7.—STOP AND THROTTLE.

can be used for warming up the cylinder before opening the throttle. The usual method of heating the cylinder by "cracking the throttle" is dangerous especially if the main contains water. The throttle should not be opened until the cylinder and steam chest are thoroughly heated by means of the by-pass. A very peculiar mode of connecting safeties to the cylinder of an engine is shown at *A* and *B*. Here there are two stop valves connected directly to the cylinder; the safeties being connected on the exhaust side of the valves. With this method of connection the safeties are not only useless, but also worthless. It should be mentioned that no valves should intervene between the cylinder and its safeties, nor between the boiler and its safety valve.

LETTERS ON PRACTICAL SUBJECTS.

HORSE-POWER CHART.

The accompanying chart furnishes a quick and comparatively accurate method of determining the horse-power in direct-current circuits. The examples given below will serve to show how the chart is used:

Suppose that the horse-power in a circuit with 30 amperes at 110 volts pressure is required. On the horizontal axis A' C', find the point corresponding to 30 amperes and erect a perpendicular to meet a horizontal line through the point corresponding to 110 volts on the vertical axis A' B'. This gives the point D. Next draw a line through D and the point on A B corresponding to 110 volts; and where this line cuts the horizontal axis A C gives the point corresponding to the horse-power required. In this case the horse-power is 4.4; while the actual value by calculation is 4.42 horse-power.

Two other examples which give results at different parts of the range of the chart are shown. One is where the current is 200 amperes and the voltage 110. The chart gives 29.5, while the calculated value is 29.49. The second example is where the current is 190 amperes and the voltage 300. The chart gives 76 horse-power, and the calculated value is 76.4.

As seen from the above, while this method does not give results which are absolutely correct, it furnishes a very simple and convenient method of obtaining the horse-power with a considerable degree of accuracy depending upon the care taken in laying out the construction. Then the chief advantage of this method over that where a table is used is that it furnishes an unbroken range of voltage and current values within the limits of the chart.

The line F G C gives the upper limit for the point D. If the current and voltage values bring the point D above this line, the horse-power is greater than 90 and is beyond the limit of this particular chart. This gives a means of readily seeing whether the given problem can be obtained on this chart.

The construction of the chart is as follows: On the vertical axis A' B' let 20 small divisions = 100 volts and lay off the voltages. Then let 20 small divisions on the horizontal axis A' C' = 40 amperes and lay this scale off from the point O. Also let 20 small divisions = 10 hp, but do not lay this scale off until the line A C is located. To do this take as an example such as the one given above, where the e. m. f. = 110 and I = 30 amperes. The horse-power is 4.42. Now from the equation $E\,I = HP \times 746$ we get the proportion $E : 746 : : HP : I$. In this proportion E = 22 small divisions, I = 15 and HP = 8.84. Therefore $22 : x : : 8.84 : 15$ or $x = 37.3$. Then 37.3 small divisions are equivalent to 746 watts.

Now place the zero of the vertical scale A B, 37.3 small divisions above the zero of the scale A' B' and make a new scale similar to A B and then draw the horizontal axis A C and lay off the horse-power scale. The horizontal distance between A' B' and A B is any convenient distance.

The chart is then completed by drawing the curve G C and the horizontal line F G through the maximum voltage on the A' B' axis. The curve G C is simply the locus of the point D for the values of current and voltage giving the maximum range of the chart.

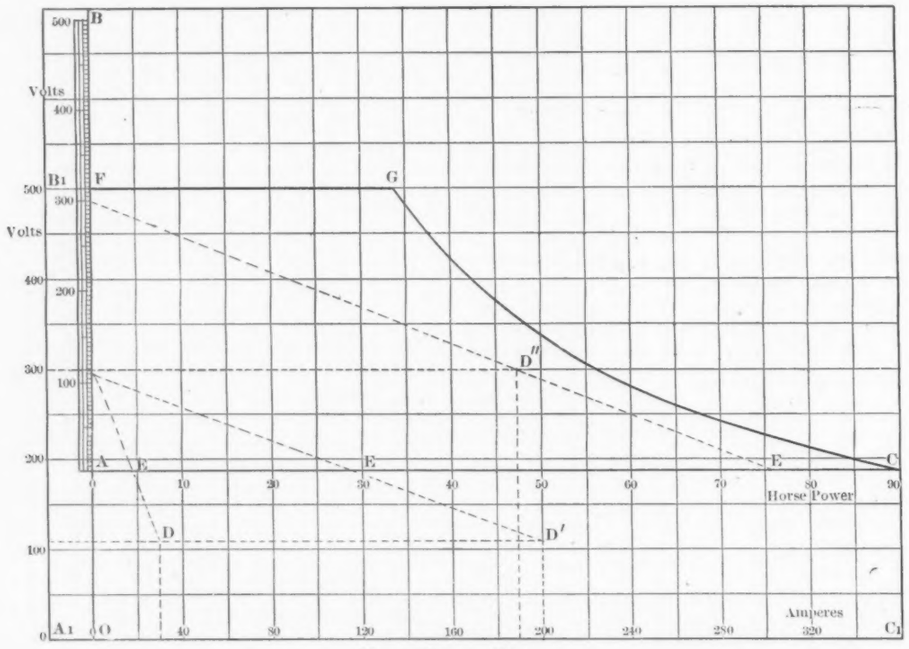
A chart for any particular range of current and voltage can be constructed in a similar manner.

Chicago, Ill. Frederick M. Sturgess.

WORKING MODELS OF INVENTIONS.

During my experience as an inventor I have met many others facing the critical problem of disposing of their wares, and in nearly every case I recall that blue prints were generally used to illustrate the points in the invention. I have seen these fellows wax eloquent when the point was raised that probably the device would not work in practice, and argue for hours against the probability of such an impossibility. When I see an inventor with a working model of his invention, I at once know him to be a fellow of some experience and past the amateur stage which may be characterized as the blue-print period. Any one who goes forth in an attempt to exploit an invention without a working model simply sets out upon a tour from which he can expect to bring home nothing but well-earned experience.

Frequently ideas which look well on paper will not work out in practice, and it is for this reason practical men will not give over-much time to presumptions in theory, but with a working model, a man's child-like love for toys coupled with his business instincts, and attention is at once riveted. The



Horse-Power Chart.

writer knows of but one case where outside capital invested in an invention that had not been demonstrated a success by a working model, and it is believed they did so to their sorrow, as the process did not develop into a mechanical success and was abandoned. The plant will remain a monument to blighted hopes and the folly of promoting patents without demonstrative models. There may be still other cases of this kind, but they are indeed rare, and the promoter of like cases are usually men of wide influence whose personality is instrumental in accomplishing the ends attained rather than the invention itself.

In nearly all our large cities are located model works, novelty shops, etc., which make a specialty of turning out models for inventors, charging fancy prices for the work and who really are no more fitted for doing such work than any other first-class mechanic and machinist, though inexperienced inventors are often led to believe that to have a model for an invention built, it is as necessary to submit the work to a regular model maker, as it is to go to a registered physician with his personal ills. A much cheaper and even better way will be to go to any first-class machine shop and engage a competent workman by the hour, whose services will usually be charged for at the rate of 60 cents per hour, use of tools and machinery included. The contracting party should oversee and direct the work himself. This will be found to be the most satisfactory, as any inoperative part of the invention can at once be righted or work suspended until the amendment can be made; besides, a working drawing can be dispensed with, which would cost almost, if not as much, as a working model itself, and which would have to be furnished were the job let to any so-called model maker. To be sure, eventually a working drawing will no doubt have to be supplied, but not until some factory has agreed to build the invention for commercial purposes, and then the inventor will be more sure of financial returns, and will not have to figuse so closely on the question of expense.

San Francisco, Cal. F. A. Tobler.

ELECTRICAL DINNER PAIL.

Most large manufacturing shops now have a generating plant for supplying electric power for the operation of machinery, and, of course, supplying also electricity to lighting circuits. In very many cases the owners would doubtless allow employees to warm their noon-day meal by connecting in circuit the dinner-pail, if such an article as a pail containing a heating coil were procurable. The latter could be placed in a double bottom filled with an attachment like a receptacle, the owner of the pail having a lamp-cord with a plug at each end, one plug being for the receptacle and the other for a lamp socket on the lighting circuit. Such an arrangement would be particularly serviceable in the summer time, when there is no steam on radiator pipes used for warming up a dinner pail in cold weather; and as the contents of the pail would only require to be warmed, not much energy would be used. The heating attachment might be sold separately and fitted to a dinner pail by a local tinner. I have at odd times fitted a number of dinner pails with electric heaters for use in shops and offices, and these are giving much satisfaction to their owners. The field appears to be a good one for manufacturers of electric heating devices.

Madison, Wis. Chas. R. Gutner.

BABBITT-METAL MELTING RIG.

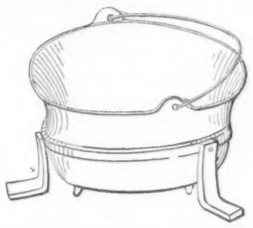
The babbitting of journal bearings is something which every station should be well prepared for, but which is most sadly neglected in dozens of power houses. At best, where there are dozens or scores of soft-metal lined journal bearings, there is nothing in the way of a babbitting outfit save a small ladle capable of holding ten or fifteen pounds of metal, and, perhaps (usually not) two or three bars of babbitt metal of unknown pedigree.

Steam engine wrist "brasses" are nowadays made with babbitt linings for the reason that should they run dry, the soft metal will melt out and bring the engineer quickly to his senses, while were the bearing of brass, as they used to be made, the engine might be put out of commission before the trouble was detected. The soft metal will melt out and ring up the engineer before more damage is done than the loss of a few pounds of "best babbitt."

Any of the numerous bearings in the plant is liable to melt out and quick babbitting is then imperative, necessitating that babbitting appliances be at hand instanter. A common makeshift in this direction, is an iron pot which may be used for melting babbitt in case nothing better is handy.

Usually, a cast-iron pot is burned out the first time a large job of babbitting is tried. Sometimes, the pot lets go right in the fire and all the babbitt goes down the tuyer iron to the despair of the mechanic and the total discouragement of the forge fire.

Sometimes, when there is no accident by heating, babbitt linings wear out and have to be replaced. When there is a large pot available, the old lining may best be removed by melting it out. For melting, an ordinary cast-iron pot or kettle is used and is placed upon the smith's fire for heating. This severe treatment usually results in very quickly burning out the bottom of the kettel or pot, making a new one frequently necessary. A pot in an Ohio plant, is said to have been



NON-BURNING MELTING POT FOR BABBITT METAL.

in constant use for more than two years, and the writer could find no signs of burning or melting in the bottom, or any other portion of the kettle.

The burning was prevented in the following manner: A ½ in. by 2 in. iron hoop was made just large enough for the kettle to set inside of it. Then, three legs, made from the same material, were riveted to the ring at equi-distant points, and the ends turned up to form feet for the support of the pot and its contents. The legs were turned horizontally near the bottom, to form feet, the distance from the bottom of the kettle to the floor, when the kettle is in the hoop, being about five inches, so that when the kettle is placed over the smith's fire, the kettle does not bear directly upon the coal, but is suspended several inches above.

The kettle used is about 15 or 16 inches in diameter, and holds enough babbitt metal for thirteen or fourteen complete boxes. To remove old babbitt, three or four boxes are placed in the kettle, being carefully lowered into the melted babbitt by means of a pair of tongs. The boxes are not thrown or dropped into the pot for fear that any water might be caught in the babbitt, or in any dirt which might adhere to the castings. Water in the bottom of a kettle of melted babbitt is something to be avoided, hence the caution used in putting the boxes into the melting kettle. Moreover, the boxes should be dried before placing them in the melting kettle.

The kettle being large, it is possible to ladle out babbitt from the kettle and babbitt boxes, while other boxes are being melted out. In fact, it is a good way to remove the boxes from the kettle as soon as the babbitt is all out of them, place the mandrel inside as soon as possible, and pour the new linings while the castings are very hot. Boxes poured in this manner seldom have loose babbitt inside of them. The babbitt shrinks, in cooling, of course, and the cast-iron casting shrinks in turn, and tightens itself upon the babbitt.

A pot, arranged as above, is one of the best things possible when a brimstone job has to be done. When an engine bed is to be set upon a stone foundation, or it is desired to bed a machine upon a rough stone without the cost of dressing the stone, set the banded pot upon the portable smith's-forge, and

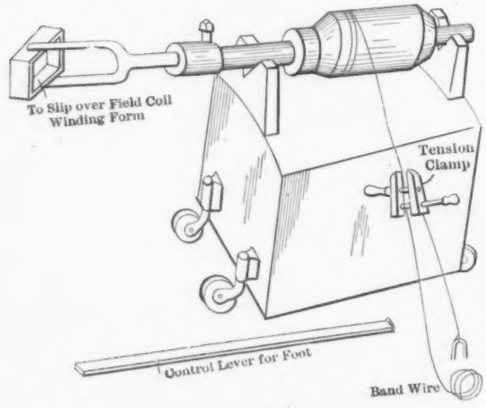
melt 50 or 75 pounds of brimstone all at once with ease and safety. There is little danger of setting the sulphur afire, and if it should ignite, a close fitting cover will extinguish the fire in a few minutes.

N. Y. City. James Francis.

ARMATURE BANDING ARRANGEMENT.

The common method of winding band wire upon an armature by means of a four-handled lever, clamped to the armature shaft, has long been obsolete in live shops, and the bands are wound in place by power, and only one man is necessary to wind a band and solder it, complete. The twine binding the cloth head-covers, is also wound on by power, and by one man, only. In order to properly describe the very simple apparatus used for winding wire and twine bands, it will be necessary to tell how the field-winder is arranged, for that appliance is made the base of the band-winding attachment.

Briefly stated, the field-winder consists of a rectangular block of wood of the proper size to receive a field bobbin. The block is fixed upon the end of a shaft, which also carries a worm-wheel which in turn engages a worm-shaft at right angles to the winder shaft. This is supported in two bearings, with the form chuck on the overhang. One end of the worm-shaft is fitted with small tight and loose pulleys, and the belt shifter which works the belt on these pulleys, is forged to fit the edges of the belt quite closely, so that there is but very little lost motion when the belt is shifted. This is done by means of a foot-treadle which extends five or six feet along the floor, past the position taken by the workman when winding bands. The end of the worm-shaft opposite the tight and loose pulleys, carries a small wood and tape pulley which drives the cut-out coil winder, described elsewhere in these columns. By a very light pressure on the foot lever above mentioned, the belt can be shifted fully, or ever so little upon the tight pulley on the worm-shaft, thereby driving the field magnet bobbin, or the cut-out coil mandrel at any desired speed, the belt slipping more or less on the tight pulley, according to the speed desired and the strain put upon the wire which is being wound in place. Thus, the wire for the cut-out coils being very fine, must be run with very little power to prevent breaking in case of a tangle, while the field wire can stand more power. The belt consequently is forced farther upon the tight pulley when field coils are being wound, than when cut-out coils are being made up.



ARMATURE BANDING ARRANGEMENT.

The armatures are wound while supported on the usual square bench, which in turn is mounted on large casters that it may be easily moved around the winding room. The notches in the tops of the two supporting arms, into which the armature shaft is laid, are levelled to coincide with the center of the field winder worm-wheel shaft as nearly as possible. A set collar, in the form of a Y-yoke on one side of the collar, is made of sufficient diameter to be placed on the end of the largest armature shaft liable to come to the winding room. A rectangular frame is made of sheet iron ⅛ in. thick, and slipped over the wooden field core. A Y is attached to the sheet-iron frame, and the free ends of the two Y's are made into the form of a universal coupling, and pinned loosely to the usual ball-shaped member found in such couplings.

Thus, with the rectangular frame slipped over the field winder block, and the Y set collar fastened to the end of an armature shaft, and the shaft in its wooden notch bearings on the winding bench, brought into line with the field winder shaft, the armature would revolve fast or slow at will, upon more or less pressure upon the foot lever controlling the field-winder. So sensitive is this arrangement, that when the operator desires to rotate the armature only an inch or two, as when trimming and fitting the wire clips, he will touch the treadle, and release it skilfully, revolving the armature just the fraction of an inch that the work requires. As the worm drive of the apparatus prevents the gearing from over running when power is off, the armature will stand in any position, even when under strain of the band wire being wound on.

A four-roll wire straightener should be at hand for use when necessary, but it does not have to be used with band wire which is placed on a reel, about 15 feet away from the armature, and on the floor. A small rope, attached to a staple near the wire reel, has an ordinary hand screw attached to the other end of the rope within a foot of the armature. The hand-screw jaws are lined with hard wood, and the band wire is caught between the clamp jaws, and given the necessary tension by tightening up the hand-screw. So well does the device work, that band wire can be wound on, the operator tapping the coils together with a piece of soft metal and a hammer, while the wire is being wound on. Upon completion of any band, the machine is stopped, and allowed to remain until the wire is made fast by a drop of solder. Then, the wire may be moved diagonally across the armature until the place for another band is reached, when the winding of that band may commence without the least delay, or without even stopping the machine.

Chicago, Ill. John Thompson.

WINDER FOR CUT-OUT COILS.

A very convenient little rig for winding cut-out, and other small coils, may be mounted on top of the field winding machine described above. The small coil winder consists of a belt-

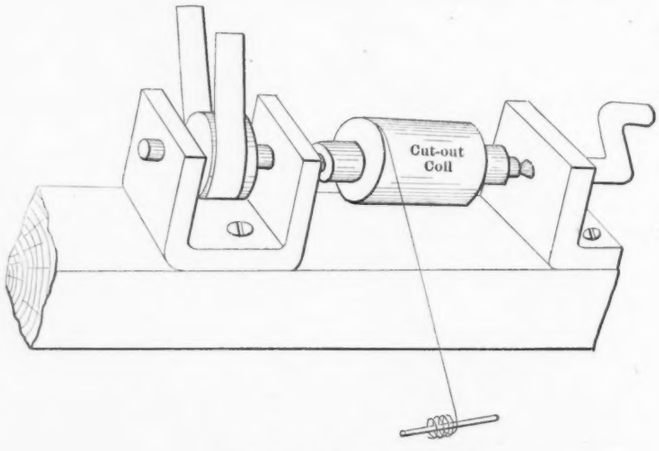


FIG. I.—WINDING CUT-OUT COILS.

ed spindle mounted in a U-shaped forging made of 1-½x¾-in. bar iron. Holes are drilled through the ends of the U to receive the spindle which is prevented by a collar from moving endwise. A hole is drilled in one end of the spindle, which is about ¾ in. in diameter, the hole being ⅜ in. The mandrel to support the coil spool, is also about ¾ in. in diameter, and just large enough to receive the spools which may be slipped one at a

time upon the mandrel, and held in place by a collar shrunk on at one end, and which receives the free end of the spindle which carries the ⅜-in. hole above mentioned.

The other end of the mandrel is fitted with a thread and a nut, by means of which the core bobbin can be caught between the collar and the nut, and thus held securely in place. The end of the mandrel which carries the nut, is also deeply centered, and another piece of the 1-½-in. x ⅝-in. iron is bent into

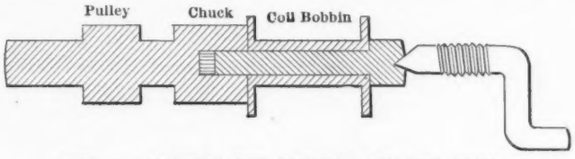


FIG. 2.—MANDREL FOR WINDING CUT-OUT COILS.

shape of an L, and tapped to fit a center which engages the hole in end of winding mandrel. The center is bent into the form of a crank and screwed through the 1-½-in. L-bar described above. Both this L-bar, and the U, above described, are bolted fast to the top of the field-winding machine frame. A ¾-in. belt to a pulley on the end of the field-winder worm shaft, drives the coil winder and it is stopped and started by a foot lever as described.

CHICAGO, ILL. JOHN THOMPSON.

STARTING MOTOR-GENERATOR SETS.

There are in existence at the present time numerous power stations, both main and sub-stations, where large motor-generator sets are used, the motor being an alternating-current machine. These sets are very often started on the direct-current side, the generator being used as a motor and the alternating-current side being cut in as soon as the machine is up to synchronous speed. This is generally done by guess-work, and if the direct-current voltage varies it is sometimes difficult to judge correctly.

Now, if there is an alternating-current arc light within range of the motor and is fed from the same source, or if is of the same frequency as the motor, it will be very easy to cut these motors in, without the least jar. Although the variations cannot be noticed, there is in an alternating-current arc, a light period in each alternation and a dark period, and if a round card is divided by radial lines into as many sections as twice the number of poles on the motor with every other section colored black, and this card is fastened to the end of the shaft, it will be noticed (if the arc throws light on this card) that as the motor comes up to speed this card will appear to be turning backwards and when it reaches exact synchronous speed, the wheel on the card will appear to come to a dead stop. As soon as the motor is cut in and a load thrown on, the wheel will, in the case of an induction motor, appear to turn backwards slowly owing to the slip of the motor and this shows so clearly that the exact number of revolutions lost by the slip of the motor can be counted. When the arc lamp does not throw its light directly on the end of the shaft a mirror can be used to reflect it.

SEATTLE, WASH. E. N. BUNCE.

NOTES ON THE OPERATION OF DE LAVAL STEAM TURBINE.

A few weeks ago an article appeared in this paper giving some practical points concerning the operation of turbines of the vertical shaft type. It is the purpose of the writer to give a few notes on the care and operation of turbines of the single-stage high-speed type, known as the De Laval.

To the stationary engineer, accustomed to Corliss engine, or modern high-speed engine operation where the speed is rarely more than 300 r. p. m., a speed of 10,000 r. p. m. is not very attractive, and about the first question the practical man will ask is, "How do you keep the bearings cool?"

About the best conception and appreciation of the enormous and unusual speed of 10,000 r. p. m. can be gained by taking an ordinary speed counter and trying to count the speed. The speed counter dial that makes one revolution for each 100 revolutions of turbine shaft, will itself make 100 revolutions in a minute. The wheel of the 300 hp turbine is about 30 inches in diameter. This at 10,000 r. p. m. gives a rim speed of 78,500 ft. or nearly 15 miles per minute. This is about 1,300 ft. per second, the speed of a bullet from a rifle. No alarm need be felt, however, as to the actual danger to life from this source, as the wheel is enclosed in a heavy cast-steel casing, and a loose blade weighing only about an ounce makes no impression on it. It is interesting to consider the effect of centrifugal force on the blades in relation to the breaking of same. The part of the blade above the rim of the wheel weighs about 9 grams or .02 lb. The formula for centrifugal force is $F = 1.23 \times W \times R \times (R.\ P.\ Sec)^2$ where W is the weight of the rotating part in lbs., R the radius in feet, *R. P. Sec.* the revolutions per second. Then $F = 1.23 \times .02 \times 1.25 \times (167)^2 = 857$ lbs. for each blade. The cross sectional area at the base of the blade (which is the point where the blade usually breaks) is about .083 sq. in., which gives about 13,200 lbs. per square inch tensile stress.

This is seen to be a very low stress for drop-forged steel whose ultimate tensile strength is often five times this amount. That this stress has some influence on the breaking of the blades there is no doubt though the centrifugal force alone is not abnormal for this construction.

From the experience we have had, the one and only direct cause of the breaking of blades seems to be that of water in the steam. Our turbines are provided with a steam separator of ample capacity and the live steam chests of turbines are fitted with drain pipes leading to high pressure steam traps. Our most serious trouble with breaking of buckets was traced directly to the failure of these traps to operate properly. After putting the traps in order no further trouble was experienced with broken blades. That water should break out the blades is not surprising; indeed, when one considers that a slug of water strikes the blades with a probable velocity of 4000 ft. per second it is remarkable that the blades are not broken in large quantities. It is a well-known fact that a bullet striking a body of water will be flattened, and conversely one may expect that water having the speed of a bullet will have a powerful effect on any body with which it comes in contact.

One way of detecting broken blades is by the abnormal vibration of the flexible turbine shaft, the missing blades throwing the wheel out of balance. As soon as this effect is noticed the machine is taken out of service and examined carefully by dropping a miniature incandescent lamp down one of the nozzles, the valve and cap having been taken off, and turning the wheel very slowly by hand. In this way all the blades may be seen one at a time as they pass the point of the nozzle. A small hand hole in the wheel case cover would be a great improvement for this purpose.

As the machines are at present constructed considerable labor is involved in replacing broken blades. The actual replacing of the blades is the work of only a few minutes to each blade, but before this work can be started the wheel must be slid out endwise several inches beyond the edge of wheel case. As the wheel shaft is solid and continuous with the pinion between the main gears, this means that almost the entire turbine must be dismantled. The manufacturers of this turbine could make a very great improvement, and one that would be very much appreciated by the operating men, by having a detachable coupling that would permit of getting at the wheel without removing so many parts.

Any good machinist can replace the blades. All that is required is to drive out the broken blades with a suitable punch and drive in the new ones, then file off the surplus metal to correspond with the blades in the wheel. We have never had a blade come loose in its socket; they break anywhere from the shank where they enter the socket to the head or tip. As to the number of breakages, we have had two machines in operation 120 hours per week for nine months and have broken less than 8% of the total number of blades in the wheels. These were broken for the most part during the initial period of operation.

Considerable trouble was experienced at the beginning with heating of the high-speed bearings. This, however, was undoubtedly due to dirt and foreign matter in the oil, or in the pipes when first put up.

Very careful attention should be given to the thorough cleaning of all oil pipes in the oiling system, and to the straining of the oil used. After getting the automatic oiling system in operation, in which all oil is filtered and double strained each time it is used, little trouble has been had with hot bearings. Some uneasiness was at first felt by the high temperature at which the two bearings on either side of the gear case operated. On a warm day the temperature would sometimes reach 250° F. However, as there was no tendency to cut or draw the babbitt, this was taken as a matter of course. A small continuous stream of oil is kept flowing over the two bearings on each side of gear case and on the bearing at the wheel end of the shaft. The two bearings, which are really only stuffing boxes on either side of wheel case, are supplied by small sight-feed oil cups, feeding from two to four drops per minute. A certain per cent of this oil is lost in the exhaust steam due to volitilization and the balance is collected and saved by means of special pockets at the sides of the wheel case. The steam used is condensed and a considerable quantity of it used again in the boilers without any inconvenience.

In regard to the parallel operation of alternators connected to these turbines, we have three-phase 60-cycle alternators and the machines run together perfectly with practically no cross current. The load on each machine can be varied at will by changing the number of nozzles or by adjusting the governor while running. The only condition under which any hunting occurs is when there are considerably more nozzles open than required for the load carried. On closing these surplus nozzles the hunting stops at once.

As to steam economy, in order to get the best results it is necessary to keep the steam chest pressure as high as possible. This means that the number of nozzles open must be as small as possible and still maintain the required speed. It is best to have a steam gauge on both the steam main and on the steam chest below the governor valve. With more nozzles open than required, the steam chest pressure will be far below that of the pressure above the governor valve, with consequent loss of economy. On the other hand, too few nozzles open will cause the turbine to drop in speed. The exact number of nozzles to keep open depends on the kind of load and kind of service required. A careful operator will soon learn to detect speed variations by sound, and his judgment will indicate how many nozzles it is safe to keep closed at any given time. The builders have recently put quick-opening valves on their nozzles which greatly facilitates the proper operation of these turbines.

Medway, O. F. J. Foote.

NOVEL BUCKSTAYS FOR STEAM BOILERS.

In some instances, contract work especially, buckstays are not sent out with steam boilers and very trying situations sometimes result; the contractor claiming that the stays should come with the other boiler castings, while the boiler man claims that buckstays are extra, as they are not mentioned in the specifications accompanying his boilers. In all cases, the buyer should see that a sufficient number of buckstays are shipped with the boiler. Some boiler "sharps" specify only four buckstays with each boiler sent out, and how to set a boiler properly, and to make sure that the side walls are properly supported, by means of only four buckstays, is a problem very hard to solve.

In many cases, the writer, when erecting plants, miles away from foundry or machine shop, has been obliged to obtain either an entire or a partial outfit of buckstays, before the boiler could be properly set. In more than one instance, at the nearest local foundry, five cents a pound has been the rate quoted for buckstay castings, and it would be several days before the castings could be made. Cast-iron was, therefore, out of the question, and some other material had to be used.

Angle iron, with three to five-inch legs, riveted together in pairs with distance pieces, makes an ideal buckstay, and is light, strong, and cheap; but not a piece of angle iron could be obtained in town. Sixty-pound steel rails were then pressed into use, but only enough for a single boiler could be obtained, while stays for two boilers—not in battery—were required.

Two of the rails were drilled to receive the rods. It was necessary to drill through the web of the rail, a heavy and

FIG. 1.—BUCKSTAYS OF RAILROAD IRON.

disagreeable job at best. Drilling was given up as being too much work under the circumstances. Some one-half-inch round iron was procured, and loops bent up which would just reach around a pair of stays set opposite each other. These loops were like two letter U's placed top to top, and welded into a solid loop.

Two loops were made for each pair of buckstays and one loop was laid into the wall at the lower end of the stays, which were then put in place. As the wall building proceeded, the upper ends of the stays being approached, the remaining loop belonging to each pair of stays was placed in position over the two stays, and then bricked into the wall, making a very neat appearance, and with sufficient strength to stand any strain likely to come along.

In one place, even railroad iron was not to be had, and it was almost decided to use wooden timbers for stays, when the writer came across some 4-inch steam pipe. Here was the solu-

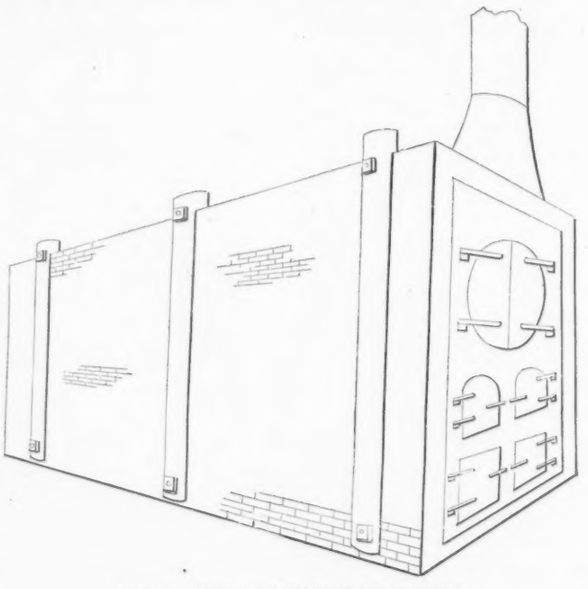


FIG. 2.—NOVEL BUCKSTAYS FOR BOILERS.

tion of the problem. Pipe was cut into pieces of the required length, and holes were drilled through either end of each pipe, to receive the anchor bolts. The stays were put in place and the brick work carried out about 1½ in. and around each buckstay, making the pipes appear, when the work was finished, as half round sections placed against the wall. This arrangement of pipes gave the setting a very finished appearance, much better than any other form of buckstays would give, be they castings, angles or railroad iron.

Scranton, Pa. John Scott.

QUESTIONS AND ANSWERS.

At what surface speed should direct-current commutation be obtained with a current of 200 to 500 amperes and a voltage of either 110 or 220 with the most efficient results? I would like to know if there is any method or rule on which generator builders figure the practical and best speed to run armatures with commutation efficiency in view?

O. N. S.

The peripheral speed should be as low as reasonable. A peripheral speed of less than 1900 feet per minute has been recommended by some designers, while instances frequently occur in designing where 3,400 feet per minute, and even over 3,800 feet per minute appear justifiable. It cannot, however, be denied that carbon brushes operate much more satisfactorily at speeds of 2,500 feet per minute and less.

We have two 200-kw, 110-volt direct-current generators connected in multiple and the instruments show about 150 to 200 amperes difference. Both ammeters have been tested and found correct. We would like to know the cause of this.

C. A. S.

This may be due to defects in the speed regulation or governing of the engines driving the generators. Note whether the resistance of the series windings and connecting leads between the equalizing bus and bus bars varies inversely as their normal full loads, so that when carrying their maximum currents the drop of potential over the series windings is the same for both machines. If not, increase the resistance of the series coil of the machine which tends to take too large a share of the load. This may be done by inserting a few extra feet of conductor of the same current capacity as the series coil between it and the main conductor or bus bar. The series field coil shunt cannot be adjusted for this purpose as any change in it will affect both machines.

Kindly inform me how to oxidize brass and copper. (2) Give formula for finding the amount of wire in feet that will go on a circular bobbin. (3) How are compound-wound motors generally connected to give a constant speed, differentially or accumulative? (4) What is considered standard for stationary motors, 220 or 550 volts? (5) Is it possible to make a dynamo to generate direct current without a commutator and also a motor to operate on the some principle?

T. N. S.

Dip the copper or brass in a solution of carbonate of copper dissolved in ammonia, and allow the material to remain in the solution until the desired tint is obtained. (2) The total length of wire of given diameter which can be wound in a given coil space is represented by the formula, $L = 65450 \times l\ (a^2 - b^2) \div D^2$; where L is the length of wire in feet, l, the distance in inches between the heads of the bobbin, a, the diameter in inches of the bobbin heads, b, the diameter in inches of the core and D, the diameter of the insulated wire in mils. (3) Differentially. (4) Both are considered standard; 550 volts being used where only street railway circuits are available. The majority of stationary motors are connected to 220-volt circuits. (5) Yes, homopolar dynamos have been built and are at present being built; homopolar motors are not, however, on the market.

What does a choke coil do, choke back current or voltage? Is the result the same on a closed magnetic circuit and one with an air gap? Is a compensator the same as a choke coil?

W. H.

The term "choke coil," when properly applied, relates to an inductive coil used in an alternating current circuit just as one would use resistance in a direct current circuit. It produces practically the same effect so far as decreasing the resultant voltage or current is concerned, although it consumes less power than an equivalent resistance would. In a choke coil, the winding is so arranged that any current which flows through the coil produces a large magnetomotive force, and this magnetomotive force in turn produces a large amount of flux on account of the low reluctance of the path which this flux is required to take. With the cyclic change in the current, there is a cyclic change in the flux, and thus an alternating voltage is produced by the rate of change of the magnetism. This voltage is in time quadrature with the current. Therefore, the coil, as a whole, acts as an inductive impedance in the circuit, and its effect on the value of the current is somewhat similar to that of a resistance. The term "compensator" is frequently applied to a transformer having a common primary and secondary winding. It becomes a plain choke coil when the secondary is on open circuit. Choke coils are sometimes constructed with open magnetic circuits; while compensators are almost always built with closed magnetic circuits, just as in the case of ordinary transformers.

Will a polyphase synchronous motor start with a load of say 50 horsepower, the size of the motor being 1000 kilowatts? Give directions for starting such a motor by connecting it to a 6600-volt line?

W. M.

A polyphase synchronous motor of 1,000-kw capacity can very readily be arranged to start under a torque corresponding to a load of 50 hp. Such motors may be started from the alternating-current end in a manner similar to that employed with rotary converters. It would not be proper, however, to use such methods with a 6,600-volt motor. Quite frequently motors wound for this voltage are started by means of a small induction motor mounted on an extension of its shaft. It would be improper for you to employ any method for starting the motor other than that intended by the maker of the machine. The best plan would be for you to obtain instructions directly from the manufacturer, because the design of the machine must be taken into account. A method which might safely be used with a machine of one design may prove destructive to a machine of somewhat different design.

In a shunt-wound motor does inserting resistance in the field circuit weaken or strengthen the field, and which of these increases or decreases the speed of the motor?

C. D. C.

The insertion of resistance in the field circuit of the motor necessarily weakens the field, and shunt-wound motors increase in speed as the field is weakened.

What is the exact significance of the terms "feeder" and "main" as used in specification and wiring plans?

E. B. K.

The term "feeder" is usually used to designate and include any circuit constituting a trunk line connection between the main switchboard or initial source of supply for the particular installation and the first feeding point or center of distribution. The term "main" designates and includes all circuits originating at feeder or main cut-outs, which serve to supply electricity for more than one branch circuit, through branch cut-outs at some distributing center. The latter term also embraces what are known as "sub-feeders" and "sub-mains."

In a recent issue a station was described which contained about 4000 horse-power in turbines and engines and only 2000 horse-power in boilers. How is it possible to feed such a capacity in engines with so small a capacity in boilers?

G. E. B.

The mechanical, or engine, horse-power is an arbitrary unit equal to 33,000 foot pounds of work per minute. The rating of boilers is also done arbitrarily. According to the recommendations of the American Society of Mechanical Engineers, a boiler horse-power is taken as the equivalent of evaporating 30 pounds of water per hour from a feed-water temperature of 100 degrees Fahrenheit into steam at 70 pounds gauge pressure. In modern plants using turbines or large compound condensing engines with high-pressure steam one "boiler horse-power" is sufficient to develop two "engine horse-power" including the steam necessary to operate pumps and other auxiliaries. An ordinary slide-valve engine operating non-condensing requires more than one boiler horse-power per engine horse-power, while direct-acting steam pumps require as much as two or more boiler horse-power per engine horse-power.

What change is necessary in order to adapt a 110-volt, fan motor for operation on a 125-volt circuit?

C. I.

None, provided the difference in voltage is the only difference in operating conditions. The motor will run somewhat faster at this higher potential and take a trifle more current; but not sufficient to overheat it.

If a 220-volt, 40-hp motor, located one mile from the source of electricity be supplied by a line consisting of No. 00 wire, what will be the drop in the line, and how is it computed?

N. E. C.

The fundamental formula is $22\ I\ D \div d^2 = v$; in which I is the current, D the distance in feet, d^2 the circular mils of the wire, and v the drop in volts. A 220-volt, 40-hp motor will take approximately 150 amperes. The cross-section of No. 00 wire is 133,100 circular mils and the distance is 5280 ft. The drop, therefore, would be approximately 130 volts, so that the arrangement is impractical.

CENTRAL STATION SALE OF CURRENT

Is the Bulletin a Result-Bringer?

By Carmelita Beckwith.

Every man has his own ideas of what he believes constitutes good advertising and what character of publicity is especially adapted to his own field of work. This is true as well of a corporation. Each has its individual complications and conditions to meet. What is good and telling advertising in one case may be disappointing in another. Perhaps more than any other branch of publicity in the electrical field, the regular publication of a booklet or bulletin, has been the topic of broad discussion.

The fact that bulletins are so numerous and are issued in such large editions indicates the general appreciation of central station managers as to their popularity and effectiveness. I have been educated myself by experience to believe in the efficacy of the bulletin in electrical missionary work, but it will, of course, be conceded that neither it nor any other medium of publicity is the only useful one to the exclusion of all others.

The Edison Electric Illuminating Company, of Brooklyn, was early in the field with its monthly publication, the *Brooklyn Edison*. For four years it was issued regularly in editions of several thousand copies, and did its share toward increasing the "equivalents" of that company. The question has now arisen as to whether the *Bulletin*, with its wide range of subjects in each issue, does not "scatter," and become expensive in proportion to its effectiveness. Beginning with this year the Brooklyn Edison Company decided to stop the publication of its *Bulletin* and start on a campaign of specialization; that is,

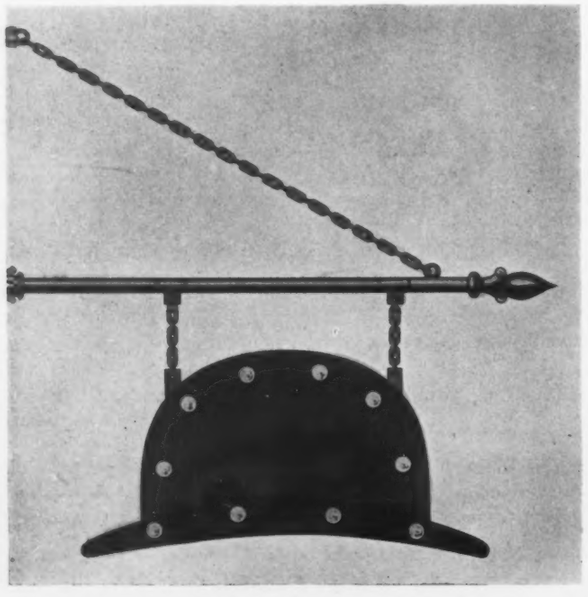


FIG. 1.—HATTER'S DAY AND NIGHT SIGN.

instead of printing a bulletin in which perhaps every phase of the business was treated under one cover, to issue each story as a separate "flyer" and send it to those likely to be directly interested in that particular story, thus saving a lot of surplus publicity. For instance, one issue of the *Bulletin* contained an illustration of handling coal by electricity; a story telling how a small storekeeper had installed an attractive sign; a suggestion of the advantages of the electric heating pad for the sick-room, and so on. To-day these stories are printed separately and sent to selected lists; the coal handling items to coal dealers; the sign to merchants, with an appropriate letter, and the heating pad story to residents using service for light only.

When I called upon Mr. Seelman, the company's advertising manager, recently, he said: "We never anticipated securing direct returns from our *Bulletin;* we simply regarded it as an educative vehicle. After four years of general education, we believe in spending the same amount of money utilized heretofore in the publication of the *Bulletin*—at least, for the coming year experimentally—on advertising from which we may anticipate direct returns, and will spend it to better advantage and reap more quickly and surely the results of our previous *Bulletin* work and other campaigns of education. To illustrate the point, here is a specific case; the Adams Express Company started to do business in Brooklyn a year ago, using horses and wagons. It was soon found that Brooklyn was entirely different from any other city, inasmuch as a widely scattered territory of 60 square miles had to be covered. Horses and wagons proved unsatisfactory. An electric truck was tried with such success that to-day this company is operating the largest automobile delivery service in the world. Where 18 miles a day was the limit of space covered with the horse and wagon delivery, to-day an electric vehicle readily travels 35 miles a day. We supply current to their various charging stations throughout the city. The superintendent of the company gave us an interview, in which he stated the various advantages of electric vehicles. Heretofore we would have

FIG. 2.—SHOE DEALER'S DAY AND NIGHT SIGN.

published this in the *Bulletin*, together with photographs, and it would have been distributed generally throughout the city along with other stories telling about residence lighting, store service or power problems. To-day we publish the story separately in an attractive form and send it, together with an appropriate letter, to all the large deliveries in the city. In this way we save superfluous circulation and secure direct results. We have recently had excellent returns from a sign campaign. Here is a circular we are sending out this week."

Mr. Seelman handed me a circular, entitled an "Electric Sign

An "Electric Sign" Block

Note this block.

It is located on Myrtle Avenue between Cumberland Street and Carlton Avenue.

This block "stands out." It is a brilliantly advertised and progressive block. It attracts attention. It draws trade. It does the business.

All these signs did not happen on this one block by chance.

No! There was an enterprising storekeeper on this block who initiated the electric sign movement. He was wide-awake and up-to-date. He realized the advertising power of electric light. He knew the business pulling value of the electric sign. He felt that the more attractive his block could be made, the more would buyers frequent it, the more business would he do. He was willing to do his share, but he wanted his neighbors to do theirs.

He called a meeting of all the storekeepers on the block. He invited an Edison representative to be present and explain the Edison free sign proposition to them.

This proposition briefly stated is that the Edison Company furnishes the sign, lights it an average of four hours a night the year round, and charges for this service a flat rate of $1.75 a week.

Cheap enough, isn't it?

The result is shown in the illustrations.

Six out of the eight merchants on the block were alive and enterprising enough to seize the idea enthusiastically. That block has now a distinctiveness and identity all its own. It's bright. It's attractive. And as aforesaid

It does the business.

There are other blocks throughout the city that could be similarly brightened to their own great advantage.

There are other enterprising storekeepers, who, we are convinced, would be glad to take hold of the matter as our enterprising friend on Myrtle Avenue did, call a meeting of the neighboring merchants and get a big block advertisement at small individual cost.

We throw the idea out for what it is worth, feeling that it is bound to find somewhere some fertile soil and take root.

We stand ready to co-operate in the matter with Brooklynites interested in increasing their business. Information in detail and every aid possible is yours for the asking.

Mail us the enclosed post card. Our representative will call at once and go over the matter with you.

Edison Electric Illuminating Company of Brooklyn

360 PEARL STREET **TELEPHONE, 4640 MAIN** **BROOKLYN, N. Y.**

Fig. 3.—An Effective Circular on Sign Lighting in Brooklyn, N. Y.

"Block," one of the illustrations of which is reproduced as Fig. 3. The "story" relates how six of the eight merchants on this one square have taken advantage of the Edison Company's flat rate of $1.75 a week for an average use of four hours a night, the year round. Besides this and other standard free signs an exclusive design, different with each trade for barbers, jewelers, druggists, hatters and shoe dealers, is furnished free to these various trades.

This work naturally demands a clean-cut, concise follow-up auxiliary, which is one of the strong points in the Brooklyn Edison Company's organization.

The residence campaign consists of ten pieces of advertising matter. One piece a week, with a keyed postal card, is sent to each person on the list, and at the end of ten weeks those from whom no reply has been received are visited by solicitors. By this time the householder is pretty well informed as to details and costs of wiring and fixtures and the advantages of electric service, and if he has not signed a contract it is for financial or other sufficient reasons.

The residence lists are compiled principally from the Brooklyn "Blue Book," while those for the business houses are secured from the solicitors, who are every day required to give the names, addresses and possibilities of three prospective customers. In this way the lists are kept alive and useful.

"We found we were not doing the business we ought with the drug stores," said Mr. Seelman. "The reason was that while they were 'long burners,' they did not use enough current to entitle them to wholesale rates. We devised the idea of going to a druggist, who was in a desirable location from an advertising standpoint, and inducing him to wire his premises for electric illumination, for which he pays the regular rates. We then installed in his place an attractive stand for holding our literature, giving him in payment for the advertising privilege a certain amount per kw-hour of his consumption. The amount he receives depends entirely upon the amount of energy he uses. We figure this advertising in the drug store is especially good, because the people who visit the place are usually the class we want to reach, and, while they are waiting to have a prescription filled, have plenty of time to read our messages. We keep the stand well filled with live advertising matter, visiting it at least once a week. We have secured 126 drug stores in this way which we could not have reached otherwise."

WIRING A RESIDENCE
In Readiness for an Electric Service
makes it more readily saleable at a higher price and is an investment--not an expense. BROOKLYN BUILDERS and HOME OWNERS----please note.
EDISON ELECTRIC ILLUMINATING CO.
Of Brooklyn
360 Pearl St. 'Phone, 4640 Main

FIG. 4.—CIRCULAR ADVERTISEMENT.

The Brooklyn Company has started a campaign intended to induce people to wire their premises and equip them for current. A great many people have been brought to a point where they realize the advantages and convenience of electric service, but the expense of wiring and fixtures stands in the way of their finally adopting it. It is with the idea of overcoming this inertia that the company is advertising in the theatre programmes, the newspapers and the elevated cars, sending out follow-up letters and following this up by personal solicitation.

NEW APARTMENTS
FINEST IN BROOKLYN
Are all equipped for electric lighting. Don't buy or lease an apartment or house unless it is wired; if you do, you miss half the comforts and conveniences of twentieth century life. An electric service in Brooklyn is practically as cheap as gas. If you are planning to move, write us and we will send you a list of all apartment houses in Brooklyn equipped for Edison service.
EDISON ELECTRIC ILLUMINATING CO.
360 Pearl St. of Brooklyn
Telephone, 4640 Main.

FIG. 5.—CIRCULAR ADVERTISEMENT.

The newspaper advertising is cleverly inserted among the "Real Estate" and "To Let" columns, two of which are reproduced. This is a direct appeal to the consumer or the user, so that he will insist upon renting only an apartment or house that is thoroughly up-to-date—wired for electric service. The advertisements also offer to supply the prospective householder with a list of apartment houses that are equipped with Edison service.

"One feature of our advertising," said Mr. Seelman, "has been its comparatively inexpensive character. Beautiful colors and elaborate pictures are very nice, but very expensive. I use them now and again, but, as a rule, half-tones and printers' ink are good enough for me. The advertising business proposition must, after all is said, appeal to the dollar and cents element in the merchant's make-up. This company is liberal in its methods and ideas, and supports the Advertising and Contract Departments by its willingness to go halfway to meet a customer."

"Electric Jingles."

One of the latest and most ingenious efforts to impress the uses of electricity upon the public consciousness is embodied in the clever *Electric Jingles*, issued primarily by the United Electric Light & Power Company, of New York City, and since taken up by several other systems. The *Jingles* are 16-page, oblong pamphlets on stiff manila paper, about 9 x 5½ ins., and are printed in large type in red and black ink. They are copyrighted by Miss C. Beckwith, who has already done a good deal of excellent work in the central station field, and they are illustrated by Mr. F. G. Cooper, whose brilliant sketches and pictures for the New York Edison Company are known far beyond the limits of this country.

The idea of the *Jingles* is to teach people that they can do pretty well anything with the aid of electricity, and this has been worked out in an alphabetical string of merry couplets all of which have a point, and some of which are decidedly witty. Each couplet has a striking little vignette picture; and the

whole is written in language that children can generally understand, although in many of the rhymes the "grown up" is aimed

FIG. 1.—THE PUSH BUTTON COVER PAGE.

at rather deftly. No child that gets hold of this dainty, simple production will stop short of knowing all about the devices thus pictured so attractively or will fail to learn something about

FIG. 2.—THE ELECTRIC GRIDDLE.

the marvels of electricity. Electric light, heat and power are all brought in, not forgetting the electric elevator and the trolley

FIG. 3.—THE ELECTRIC CHRISTMAS TREE.

car; while the utilization of Niagara and the mystery of transmitted music are also introduced to the contemplation of growing intellects. Incidentally there are one or two sly shots at private plants and a sharp criticism of poor old steam.

"Do it with Electricity" is the rallying cry of the central station manager, and in this happy little brochure, which ought to enjoy an effective circulation of many hundred thousands, he has a new aid, and a bright exemplar, in reaching his public.

Schemes for Increasing Business.

Mr. John G. Learned, contract agent of the North Shore Electric Company, operating in the suburban towns around Chicago, presented a paper in competition for the Co-operative Electrical Development Association's prizes last spring, which contains a number of interesting statements as to schemes his company has worked in securing new customers. The following are extracts from his paper:

Experience taught that in order to get the best results agents must be paid a salary and a very liberal commission on business secured. By doing this, the results were far more satisfactory than when a straight salary was paid. It is absolutely necessary at times that the central stations should maintain a wiring department and should also encourage private local parties in the wiring business. The more competition in the wiring business, the quicker your load will grow. If necessary, throw a few wiring jobs to the local man. Induce the man selling appliances to visit your territory. This also pays. If feasible, get all and any firms handling reliable electric appliances to solicit in your community.

We all know that the residence owner hesitates to have his home torn up, as he thinks it will be, and sometimes is, in order to install electric lighting, wiring and fixtures. Again, the expense prevents a man taking this step to comfort and convenience. Give the resident prospect a cost estimate for wiring his place. We find that by offering to put in the wiring and fixtures at cost on monthly installments, we have secured a very large number of old houses which, if it were not for this proposition, would still be using antiquated methods of illumination.

It is the old residences that need the most attention. New ones will come in as a matter of course. It is a very easy matter to induce a man building a new house to have it wired. Wiring for a porch lamp at cost has been the means of securing a very large number of customers. Sixty customers were secured out of 275 people approached by a circular letter, which is a very large percentage. The cost of operating a porch lamp is nominal and rarely runs over 75 cents or $1 per month. It pays to put in a service for one lamp because it is only a short time before the entire house or part of it is wired. After the porch lamp, the next proposition for an old residence is to wire for six outlets at a price of one-half of the actual cost, the outlets mentioned to be placed as instructed by the consumer with restrictions according to the conditions existing in the particular locality. Six outlets will give the customer a chance to try the light, and it will invariably result in ordering additional lamps. This proposition was offered to about 600 old residents, out of which 53 responded and 23 were secured to the service. The average man is always ready to accept something which is apparently free. Therefore, for a period of three months make a standing offer to allow $25 worth of energy free to any resident who wires his home for a certain number of lamps during that period, said free energy to be used within a specified time. The results from this offer were very gratifying; in fact, flattering, as about 40 old houses which before making the offer were almost impossible to reach readily came on the service.

The following very attractive proposition was offered to a selected list of about 200 residents who owned their homes:

"We will bring our lines to your premises, install our service and at your direction wire for not to exceed six single electric light outlets, entirely free of cost.

"We would suggest a light for the porch, controlled by a switch in the vestibule; one in the library for a reading lamp; one in that dark clothes closet which will eliminate all pos-

sible danger of fire, and one in the furnace room, controlled by a switch at the head of the stairs.

"All we wish is that you agree to use electricity for burning the lamps for two years, and that your monthly bill be at least $1.

"It is our intention to make but 100 of these installations, and the first 100 applications we receive will obtain this wring free of cost. This involves an expenditure of a very considerable amount of money on our part, and if at any time you conclude to equip your premises throughout for the use of electric light, it will make a very material saving in the expense.

"The enclosed postal-card with your name and address, mailed to us, will bring our representative, who will be pleased to give you full information on the subject."

Seventy responded to this letter, and, as a result, the central station was successful in securing 47 old residences, all of which are considered very good customers. Their bills average about $3.50 per month, this average taken for a period of eight months. The average cost of wiring each of the above houses mentioned was about $20.

The foregoing are a few of the schemes which have been used with success in obtaining old houses on the system. A new proposition will always in bring in a few of the old residences.

Most towns have a few tenement and flat buildings, and it is sometimes a task to obtain the lighting of these buildings. It is a good policy to have them wired at any cost, having the halls wired separately from the flats. This being done in the first place, the rest is easy. As a rule, tenants in flat buildings are very good customers, easy to secure and easier to hold. In order to secure and hold the hall lighting, allow the owner a special commission in the form of a discount on his hall lighting, this discount depending upon the number of customers in the building which use the service. As a result of this proposition, the owner or agent of the building are instrumental in having a backward tenant use light. This proposition also applies to office buildings. Right here it is important for the district solicitor to win the heart of the janitor of the building, as he is of great value to the central station in securing flat customers, as he is on the ground with the prospective customer at all times and a word from him goes a long way in convincing the prospect that he should use electric light.

The problem of securing store business we are ready and willing to admit is a very difficult one. Many schemes and methods have been tried. The writer suggests, however, to start the wayward store customer using electric light by first getting him interested in lighting his windows. To him window lighting is a matter of experiment. In order to show him that it is not an experiment with you, but an absolute necessity and that you have confidence in the fact that he will continue to use electric service, wire his windows free of charge. You may hesitate to do this, but it is good business. It is not only an advertisement for the storekeeper, it is also the best advertisement the central station can obtain. Induce him to use the light in his windows when he has closed the store. In order to sell goods you must show them, and show them under the most favorable conditions. This may be done by using electric light. Teach him how to light windows, and why, because it is his best advertisement. Impress upon him the necessity of showing his goods and show them under the most favorable conditions. In a district where you find that it will pay to maintain patrol service, install arc lamps on a flat rate basis.

One branch of the electric lighting business too often neglected is signs, which means big revenue and is a good advertisement. Hang a sign in front of your office; also one or two in another portion of your town to advertise your business. If you show the public that you believe in signs they will follow suit and you will find that the sign business will grow. Adopt a standard sign. There are several companies that now make a specialty of furnishing central station companies signs at a reasonable price, which may be used time and time again. Signs furnished free to the customer have been means of securing a vast amount of business. By free the writer means that the signs are furnished, hung and connected without expense to the consumer, under a special contract whereby he agrees to use a certain amount of energy each month. If patrol service is convenient, furnish the sign on patrol basis; if not, on meter basis.

It is often surprising to learn of the many places where motors may be installed. Sell motors at cost or as near cost as possible. Sell them on time. Rent them. Place a motor in on trial. In fact, do anything and everything to obtain the consent of the consumer to take power service. The writer does not know of one case in which the service once installed was removed.

The Introduction of Heating Devices by the Central Station.

In a recent issue of the *General Electric Review* Mr. E. L. Callahan presents an article on the "Commercial Importance of Heating Devices to the Central Station," in which illustrations are given of work done by several progressive companies in this direction. The following facts are taken from this article, supplemented by observations made in the field by one of our editorial staff when visiting the companies in question. The

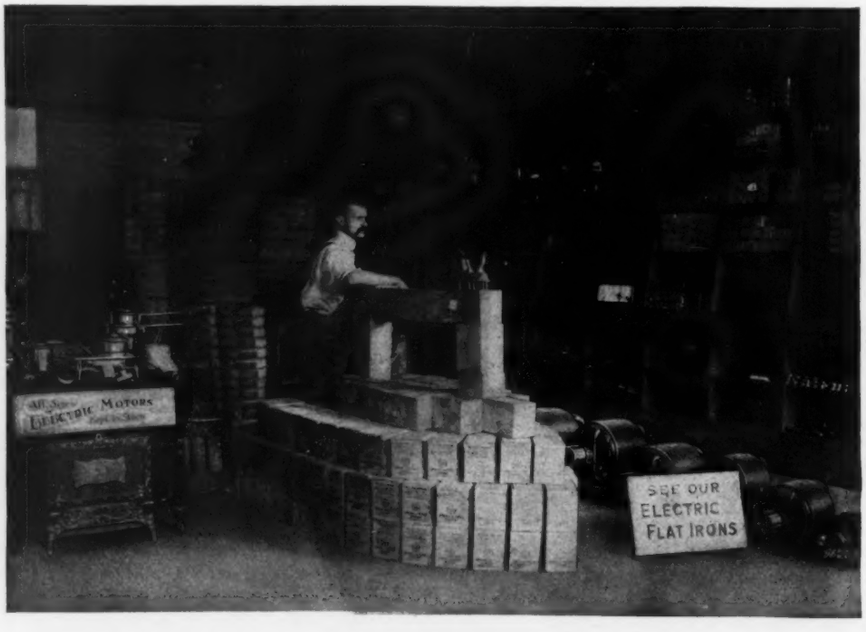


FIG. I.—STOCK ROOM OF THE DALLAS ELECTRIC LIGHT & POWER COMPANY.

ELECTRICAL WORLD in the past has emphasized the necessity of a good display at the companies' offices. There should be an attractive show-window exhibit, and the exhibit loses its effectiveness unless it receives a little daily attention. Mr. Callahan has seen show-window exhibits so dusty and dirty that it was a relief to look across the street instead of at the conglomerate mass called the window exhibit. A large pile of

flatirons or other devices impresses the public with the fact that the company is doing a good business. It looks prosperous and shows the company's confidence in stocking up.

Fig. 1 shows the stockroom of the Dallas (Tex.) Electric Light & Power Company. In this case the stockroom is in a half-basement in full view from the public street, and hence is in a certain sense a display room. The pile of flatiron boxes built up in the shape of a flatiron is the central feature in the stockroom, and cannot help being impressive to the ordinary passer-by as to the amount of electric flatiron business the company is doing. Fig. 2 shows the attractive demonstration room of the Milwaukee Electric Railway & Light Company, where a great variety of electric heating and cooking appliances can be seen.

The Minneapolis General Electric Company has one of the most attractive exhibit rooms to be found anywhere in the country. Fig. 3 is from a photograph of the front of this exhibit building at night. As the company did not have room for an exhibit in its general offices, the small building seen in Fig. 3, several doors away from the office, was rented. Across the top of the building is the large electric sign "Electric Exhibit." The exhibit room itself is small, but is painted white and flooded with light. The lamps are arranged and equipped so as to show a number of different styles of lighting without producing a conglomerate or mixed-up effect. A few motor applications are shown and the front window is taken up largely with a display of heating appliances. This room being finished in white and being illuminated so much better than any other store along the street is very striking at night, as well as attractive in the daytime. This showroom of the Minneapolis General Electric Company is estimated by Mr. A. W. Leonard, manager of the company, to bring in an increase in gross revenue at the rate of $1,000 a month. This estimate is made by figuring the probable increase in the customers' monthly bills resulting from use of the apparatus sold through the medium of the display room. At this rate, the company considers the display-room a decidedly profitable investment, as the rent is only $75 a month and two men look after it. During the latter part of 1906 this company was putting out electric flatirons on trial at the rate of about 100 a month, of which about 80 per cent would remain where they were placed. It is found important to attach a slip to bills where electric flatirons have been placed, calling attention to the fact that the iron had been in use; otherwise an undue number of complaints would come in as to high bills. When the slip was attached there were practically no complaints. The use of such a slip is considered by Mr. W. Randolph Sweany, contract agent, a very important detail which, when omitted, may make considerable trouble, judging from the company's experience. Fig. 4 shows the back of the postal-card sent out by the Minneapolis General Electric Company to prospective flatiron customers in advance of the demonstrator.

The electric flatiron has been called the entering wedge of heating business and the enormous quantities of irons sold in 1906 prove that the 30 to 60-day free trial proposition extended to the public by nearly every central station handling irons was a good one. These irons have been successfully distributed in wagonloads without previous solicitation. Other heating devices not being so mechanically indestructible are scarcely adapted for free trial, but the progressive central station man will set aside from his stock one or two devices of each kind for loaning on special occasions. Each loan of a device should bring a sale; each loan of a chafing dish at a party should, if followed up, sell from one to six.

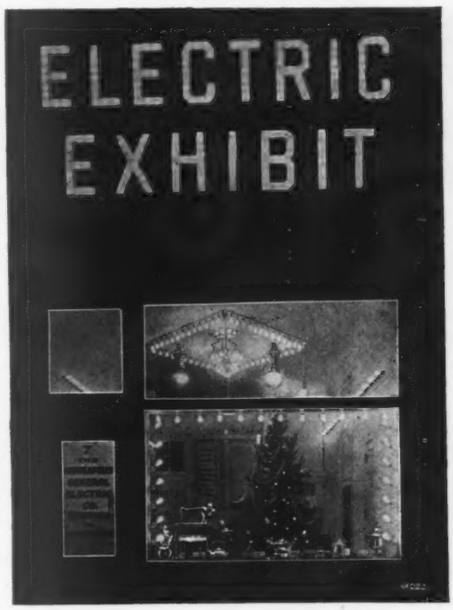


FIG. 3.—SHOW WINDOW AT NIGHT, MINNEAPOLIS.

FIG. 2.—DEMONSTRATION ROOM OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY.

In the earlier days, it was thought that the wealthy only could be induced to purchase electric heating devices. On the contrary, the large quantities of flatirons and other devices sold during 1906 did not go into wealthy homes, but into the homes of people who are thoughtful of the comfort of their servants or where the mistress of the house does all or most of her own work. The solicitor will find that this class of people gives him the most heating business; for any device that will lessen labor, give more comfort and operate without inconvenience is welcome. The solicitor should be an enthusiast, and have a firm and thorough knowledge of the practicability and durability of the devices. He must be able to impart his confidence in the merits of the devices to the prospective customer, as, due to unfamiliarity with electric matters, fears from electric shocks are even yet quite general in the feminine mind. The solicitor should also not lose sight of the large amount of heating business in the industrial field, which has scarcely been touched as

yet. Several central stations have found young women solicitors very efficient, indeed. In St. Louis nearly all of the elec-

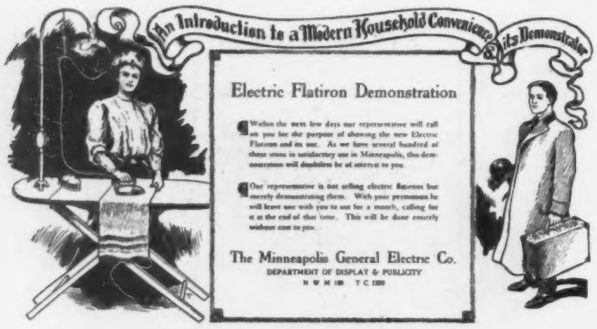

An Introduction to a Modern Household Convenience & its Demonstrator
Electric Flatiron Demonstration
The Minneapolis General Electric Co.
DEPARTMENT OF DISPLAY & PUBLICITY

FIG. 4.—BACK OF POSTAL CARD.

tric flatirons in use were put out by young women solicitors and demonstrators.

Experiences with Electric Cooking in Oak Park, Ill.

Mr. E. L. Callahan, of the Chicago office of the General Electric Company, has done all the cooking electrically in his home at Oak Park (a suburb of Chicago) since June 23, 1906. Figures on the results will be of interest to all central station men who are studying this new possibility for income. The family averaged 2.51 persons for the first five months and 3.69 for the three months ending Feb. 22. The total kw-hour consumption for the eight months, June 23 to Feb. 22, was 533, costing at the 5-cent per kw-hour rate given by the Oak Park Yaryan Company for electric cooking, $26.65. The total number of single person meals for this period was 1857, making the kw-hour per person per meal 0.287. At 5 cents per kw-hour the cost is 1.43 cents per person per meal. The foregoing figures on kw-hour consumption do not include ironing, as the ironing was on the lighting meter.

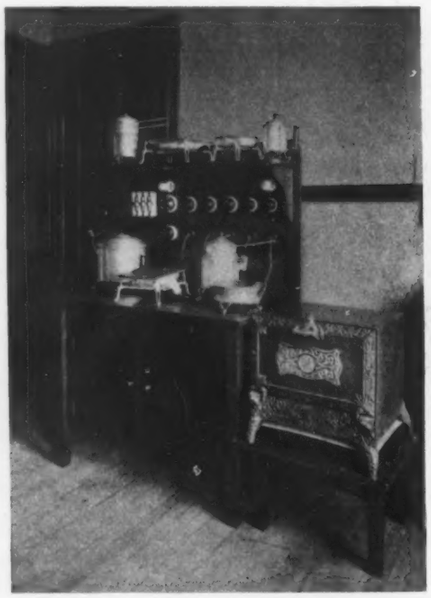


FIG. 1.—COOKING CABINET IN USE.

For the month of February (28 days) a record was kept of all the dishes cooked. For this month there were 268 single person meals. The kw-hour consumption was 87. The kw-hours per person per meal was 0.324. The number of meals served was 93. The number of dishes cooked, not including baking and roasting in oven, was 360. Warming and pasteurizing baby's milk were each counted as dishes. The oven was used a total of 22 times, as follows: Seven bakings of four loaves of bread or equivalent in rolls and rusks; two bakings of cake, 13 roasts, etc. It is thought probable, although no records were kept the first seven months, that the oven was used more frequently previous to the month of February than it was during that month, since the kw-hours required per person per meal were notably higher during February than for the total eight-months period.

FIG. 2.—COOKING CABINET CLEARED.

Following is a list of the electric cooking utensils used, all being of General Electric Company manufacture:

Six-qt. vegetable or soup boiler; 2-qt. vegetable and cereal cooker; 2-qt., 1-qt. and 1-pt. water heater; 5-in. and 7-in. diameter frying pan; 6-in. diameter stove; 12-in. diameter griddle; 12-in. diameter broiler; an oven.

Figs. 1 and 2 show the electric cooking cabinet and oven used. The cabinet is of the latest type turned out by the General Electric Company. Fig. 1 shows the cooking utensils in use on the cabinet. Fig. 2 shows the cabinet cleared off with the cords pushed back through the bushings in the back of the cabinet. The cabinet has two indicating lights—one on the oven circuit and the other on the remaining circuits. A main switch is provided by which all the cord circuits can be cut off to make sure that no device has been left turned on. Fig. 3 shows the side table employed in Mr. Callahan's dining-

FIG. 3.—SIDE TABLE IN DINING ROOM.

room for the chafing dish and coffee percolator. Fig. 4 shows the wiring of this table. The cord is taken up from a flush

FIG. 4.—WIRING OF SIDE TABLE.

receptacle of the back of this table. On the back of the table are two flush receptacles, into which cords from the coffee percolator and chafing dish can be plugged.

LETTER TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World:

Sirs—I have read with much interest in your first issue of March, an article describing the erection of poles, towers, etc., for the support of aerial wires in connection with radio-telegraphic apparatus, and in this connection I should like to say something concerning the transmission and reception of telegrams wirelessly, with and without the use of high aerial wires or conductors.

For some time past I have been engaged in experimental research with the object in view of ascertaining, if possible, the kind of apparatus necessary for the accomplishment of continuous and perfect transmission of radio-telegraphic pulsations. In using the aerial I have found after numerous and exact experiments that the high wire is comparatively of no value for continuous and syntonic transmission, on account of the cumulative effect of atmospheric electricity on said wire, which effect is more than sufficient at times to operate the receiver, record false signals, and perhaps burn out the apparatus, thus endangering the life of the attendant or operator who might be near.

In consideration of the above I therefore set about to construct apparatus with which I could communicate continuously day or night during stormy or clear weather, without the use of the high aerial, and I have succeeded to such an extent that I am perfectly satisfied with results gained.

I may say that I communicate, with great accuracy (*as perfectly as by wire*) over a distance of half a mile or more in the city of Chicago, with steel constructed and other large buildings intervening, these buildings entirely screening the instruments, which are situated each in its own respective room, on the ground floors, and having no wire or other artificial conductor whatever outside.

The instruments I have are quite crude, and are made up of anything suitable that came to hand; nevertheless they are very effective, when considering that the power consumed in operating the transmitter for the above distance, is not more than 22 watts, and the action of my detector at the receiver is so intense for the given distance, that the pulsations can be heard when the telephone is placed some 8 inches from the ear; these results being gained with apparatus weighing in entirety not more than 60 lbs.

In conclusion I will state that I can carry my receiver to a building, set it down on a chair, throw a switch, and when a message is to come, a bell will ring, and communication has started: no aerial, or metal cylinders, or analogous conductors being necessary.

CHICAGO, ILL. GEORGE S. PIGGOTT.

[At a demonstration with Mr. Piggott's apparatus in Chicago signals were transmitted a distance of about ¼ mile with numerous brick and some semi-steel frame buildings intervening. The receiver was in a small box which was set behind a piano with the idea of getting as much screening effect as possible. The only metallic connection to the receiver was a ground wire attached to a steam radiator. The sending station had no aerial conductor.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Measuring the Hysteretic Loss of Transformers at Slow Cycles.—KAPP.—A description of a simple method for determining the hysteretic loss in a finished transformer. It requires only a single observer, who need have no more skill than is necessary for handling a stop watch and reading an ammeter. In Fig. 1 *B* is a battery consisting of one or a few secondary cells capable of giving a current about 50 times greater than the magnetizing current of the transformer; *r* is an adjustable resistance: and *M* a fixed resistance between the terminals of which the e. m. f. *e* is maintained approximately constant whatever may be the current taken up or given out by the transformer coil *T*. This e. m. f. is indicated on the voltmeter, *V*, whilst the current flowing through the transformer coil is read off on the ammeter, *A*. *U* is a reversing switch. The ammeter must have a central zero, because the direction of the current changes during the test. *T* may be the fine-wire winding alone or, better still, the combination of both windings coupled electrically and magnetically in series. Let the resistance in the branch circuit be *R*, then $I = e \div R$ is the maximum value of the magnetizing current when the steady condition has been reached. Now let the switch be knocked over and at the same time the stop-watch started. Observe *A* and stop the watch at the time that the index passes a predetermined value (*i*) on the scale. By repeating the process a series of co-ordinate values of *i* and *t* can be obtained step by step. After the pointer *A* has passed the zero a little way, its movement becomes so slow that step-by-step observation can be replaced by continuous notation. In a 7-kw transformer, for instance, the time required by the

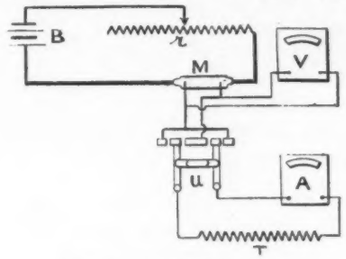


FIG. 1.—TEST CIRCUITS.

pointer to reach its end position was about 100 seconds—that is amply sufficient to take and note some six or eight consecutive readings. If these readings be plotted, the curve shown in

Fig. 2 is obtained. The area enclosed between this curve and the time axis represents coulombs, and if multiplied by e it shows joules, the lower part is energy returned by the transformer to the main circuit, and the upper part energy given by the main circuit to the transformer. The difference is the energy wasted by the transformer during one-half cycle. This contains also the copper heat, but as we are only interested in the energy lost in the iron, we must yet correct for $i^2 R$ loss, which can be conveniently done graphically as indicated in the figure. We thus obtain the dotted curve. Now planimeter the area lying between the full and dotted curve, counting the part from O to t_0 negative and the part from t_0 to t positive. The resulting area multiplied with e represents watt-seconds used up in hysteresis in one-half-cycle for the whole of the iron concerned in the process. The author then describes how to determine the hysteretic loss as a function of the total flux. This can readily be done if the number of turns of T is known.—Lond. *Elec. Eng.*, February 15.

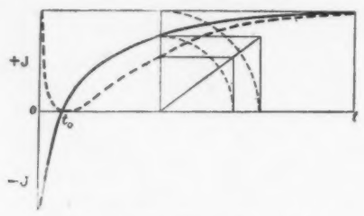


FIG. 2.—HYSTERESIS LOSS.

Breakdowns of Electrical Machinery.—Foster.—A paper read before the Manchester section of the (British) Institution of Electrical Engineers, giving statistical data on breakdowns of electrical machinery. The number of motor breakdowns annually average one for every nine in use, and of generators one in thirteen. 58 per cent. are due to armature failures, 11 per cent. to magnet coils, and 18 per cent to commutators and brush gear. The actual causes of breakdown cannot be ascertained so accurately; 25 per cent are classified as "unascertainable," 12 per cent as accidental, 18 per cent. due to dirt or neglect, 22 per cent age and deterioration, 18 per cent bad design or workmanship, and 5 per cent overloading. The author reviewed in detail the preventible causes of failure in the various parts of the machines. Among other things, he pointed out that it is often a fallacy to consider that former-wound armatures are easy to repair, because the insulation with which the coils are impregnated is often so binding that the coils are damaged when lifting them, and it becomes necessary to rewind. He suggests also that, as the wedges for retaining armature windings in position frequently come out, they should be supplemented by mental binders. Fracture of shaft occurs too frequently, and he therefore objects to the general tendency of discarding spiders and keying the core plates directly to the shafts. "Built-up" mica on commutators often gives trouble, and he asks for a new and better material than this. The armatures of crane motors are sometimes damaged by excessive speed when lowering, but this is now receiving attention at the makers' hands.—Lond. *Elec. Eng'ing*, March 7.

Heating of Machine Coils.—Ott.—An illustrated account of experiments in which the author tested the heating of armature and field coils. He determined the heat conductivities of laminated structures and the maximum temperature rise in armatures as well as in field coils.—Lond. *Elec.*, March 8.

Lamps and Lighting.

New Lamps.—An account of a discussion before the Birmingham section of the (British) Inst. of Elec. Eng. on recent improvements in electric lighting. Foster gave the following figures on the cost of running various high-candle-power lamps on 220-volt direct-current. The figures given are the cost for one lamp for 1000 hours and include electricity (or gas), carbons (or mantles), cost of attendance, repairs. The 9-ampere 17-hour flame arc with "chemical carbons," $27.00; the 7-ampere, 40-hour (magazine) flame arc with "chemical carbons," $19.75; the 5-ampere, 120-hours single-inclosure arc, $20.43; the mercury-vapor lamp, $28.16, and the 350-cp high-pressure gas lamp, $21.56. The candle power of the different lamps is not given. According to Craig the specific consumption of the flame arc lamps is 0.24 watts per mean spherical candle power. Sumpner called attention to the diffusion of light and the increase of light owing to diffusion. If one compares an ordinary lighted room with one containing the same lamps but with glass walls and roof, the former will contain about twice as much illumination as the latter, simply because there is no reflection of light in the latter case. "With white-washed walls and ceiling the light due to repeated reflection may be increased as much as five times. Taking an average case the walls reflect about 60 per cent. and the light is really increased twice. That occurs in all kinds of interior lighting where incandescent lamps are generally used. With arc lamps it does not apply because they are not used in the same way as a rule. In comparing the cost of lighting this fact must be borne in mind." Fennell said a very important point with regard to the tantalum lamp is the grading of the same. He found that "they vary as regards current up to about 20 per cent and on attempting to put them in series the result is disastrous."—Lond. *Elec.*, February 22.

Search Lights.—Hall.—The Suez Canal regulations stipulate that all ships traversing the canal at night shall project a beam of search light forward which shall have a shadow in the centre of five degrees divergence. Thus in reality the projector sends out two beams of light, one to the right and one to the left which light up the sides of the channel, showing clearly the position of the buoys on each side, while the passage directly ahead of the ship is not illuminated. For this purpose Parsons invented a mirror which gave the necessary divergence of light and to obtain the shadow a metal plate was put down in front of the projector. The present author shows that ordinary dispersion lenses could be used for the same purpose.—Lond. *Elec. Rev.*, March 1.

Power.

Refrigerating Plants.—Barnard.—An article on the advantages of electrically-driven refrigerating plants for small shops like milk stores, butcher shops, etc. The Berlin electricity works, in connection with a refrigerating-machine builder, have brought out a convenient machine-set for this purpose. An installation in a medium-sized restaurant in Brixen in Austria is described. The compressor and condenser are mounted together and the electric motor is provided at the bottom. The whole machine set requires not more than 6.5 sq. feet area. Ammonia is used as the refrigerating medium, and water from the municipal supply is used for cooling. To produce a cooling effect of 1200 calories (in how much time?) the motor consumes one hp and if by increasing the supply of cooling water the cooling effect is raised to 2000 calories, the motor consumes 1.3 hp. The attendance is very simple since it is needed merely to turn on and off the cooling water supply and to start and stop the motor. The first cost of the complete installation was not quite a thousand dollars. The yearly running expenses comprising cost of energy, cost of cooling water, and the cost of renewing ammonia, is somewhat more than $30. The space which is cooled has an area of 43 square feet and is 8½ feet high. No special labor is needed since any servant can attend to the machines.—*Elek. und Masch.*, March 3.

Electric Power in Textile Mills.—An illustrated article on the increased use of electric driving in English textile mills. Some 20,000 hp of motors have been installed or are on order for textile driving, the bulk being for Lancashire mills. The advantages are saving in power and increased output. It has been pointed out that an increased output amounting to only 2 per cent. is sufficient to wipe out the coal bill of a mill. Concerning individual or group driving it is said that according to practical experience there is not any great difference in first cost when every item is considered, and as regards economy in power the slightly decreased electrical efficiency of the smaller motors with individual driving must be pitted against shafting and belt

losses with the group drive. A recent new installation is described in which, however, the group driving is used throughout, some 600 hp of motors being installed in the mill, all being squirrel-cage induction motors.—Lond. *Elec. Rev.*, March 8.

Electric Winding.—An account of the discussion which followed Wood's paper recently abstracted in the Digest, on some new flywheel storage systems for use with electric winding. Peck criticized in detail the different systems described by the author, while Corlett thought that the control would be far more difficult in Wood's arrangement than in the Ilgner system. The whole control of the Ilgner winding plant is effected in the shunt circuit of the machine. The main current is never broken, and consequently the operating mechanism is inexpensive to keep in order. Further, the speed of an Ilgner winder can be varied within enoromus limits, and the speed is practically independent of the load. In the case of a large three-phase winding motor, such as Wood referred to, taking, say, a maximum horse-power of 1800, he rather thought that the switchgear which was going to stop and start the arrangement and regulate the speed within the necessary limits, would be a somewhat elaborate piece of mechanism. He had seen such a switchgear at a colliery in Germany, and the switchgear had a huge room all to itself, and no one dared go into the room without blue spectacles.—Lond. *Elec. Eng'ing*, March 7.

Direct-Current Series System.—HIGHFIELD.—The first part of an illustrated paper before the (British) Institution of Electrical Engineers on the Thury direct-current high-tension series system of energy transmission.—Lond. *Elec.*, March 8.

Gas Engines.—BIBBINS.—Some illustrated notes on improvements in gas-engine ignition.—*Elec. Jour.*, March.

Electric Power for Ship Building.—An illustrated article on modern electrically-equipped ship-building berths.—Lond. *Elec. Rev.*, March 1.

Installations, Systems and Appliances.

Paris.—A review of the present situation of electricity supply in Paris. The contracts of the supply companies with the city will soon run out, some in April, 1907, and others in August and December, 1908. It is not expected that the old contracts will be renewed. The urgent question is not at present whether municipal ownership of electricity supply is to be introduced. The question is rather what shall be done with the present stations—whether they shall be removed or developed to greater extent. At present Paris is divided into big districts. The South and Southwest are supplied with alternating current and the North and Northwest with direct current. The total energy consumption in 1903 was 33,000,000 kw-hours, the number of subscribers 36,000. The consumption of energy increased from 1899 to 1901, and to 1902 and 1903 in the ratio of 1. to 1.5 to 1.65 to 1.8. According to the report of a special committee a capacity of 80,000 kw is first projected, distributed over three stations. Steam turbines are preferred in units of 5000 kw. The facilities of supply with fuel and water are considered the chief factors for determining the situation of the three plants. Polyphase currents at from 8000 to 12,000 volts are recommended with a frequency of 50. For the districts north of the Seine River in which the load is very high, direct current is proposed, for all other districts alternating current. The estimate of the cost of producing one kw-hour is 3.1 cents if only fuel, attendance and management are considered in the cost. If interest, amortization, etc., are included the cost of producing one kw-hour is estimated at 6.58 cents. The project of Schneider & Co. and Milde & Co. appears to have the most prospects of being accepted. In this project the primary voltage of the three-phase currents is 10,000, the frequency 50 and the secondary currents of the distribution net work are direct current at 2x110 volts and three-phase currents at 3x110 volts. Another project by Harle, Blondel & Maehl has been much discussed; it proposes to utilize the Rhone water falls with a transmission line of 270 miles length to Paris. It is estimated that the eventual yearly consumption of energy in Paris, for lamps, stationary and traction motors, etc., will be 700,000,000 kw-hours, but for the beginning 200,000,000 kw-hours are to be supplied.—*Elek. Zeit.*, March 7.—Extended notes on the subject, reprints of official documents in *L'Industrie Elec.*, February 10, 25.

Electrical Steam Pressure Regulator.—A description of a method which may be used for electric regulation of the steam pressure in such cases where electrically-driven mechanical stokers or fans are employed. The steam pressure is regulated by automatically adjusting the motor speed to its normal value. The arrangement is shown in Fig. 3. 2 is a steam-pipe from

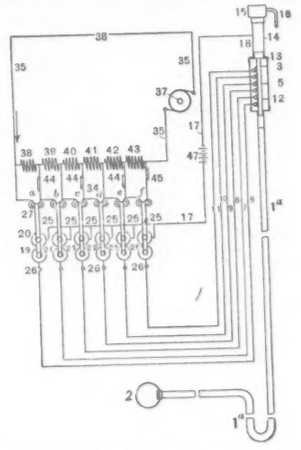


FIG. 3.—ELECTRICAL STEAM PRESSURE REGULATOR.

the boiler whose pressure is to be regulated; 1a is a U-tube filled with mercury, screwed into 2; to the top of this mercury tube an insulation tube 3 is attached. The front of tube 1a, surmounted by 3, is perforated, and contact pieces are attached to the inside of the insulation tube. These contact pieces are connected to the leads, 6 to 11; these lead to a number of electromagnets, 19 to 25, all connected through a common line, 17, with an auxiliary source of current, 47; 37 is the motor driving the fan or mechanical stoker, and it is connected to the supply, 36, through the resistances 38 to 43. The resistance ends are led to mercury cups, *a* to *f*, which are normally short-circuited by the electromagnet armatures. So long as the mercury in the tube is below all the contacts, the auxiliary circuit is open and the magnets unexcited, so the motor 37 runs at full speed off the whole supply voltage. If, owing to too much draught or too vigorous stoking, the steam pressure rises above the normal, the mercury rises in the tube 1a, and as the contacts are reached by the mercury column in turn, the resistances are inserted into the motor armature circuit in turn, and so reduce its speed. The power and speed of the motor are chosen so that under normal conditions the machine runs with some resistance in the circuit, so that regulation up or down is obtainable.—Lond. *Elec. Eng.*, March 1.

London.—PEARSON.—In a continuation of his illustrated serial of power supply from electric central stations in London, the author deals with the Fulham Borough Council. This is a residential rather than an industrial district, but the load has continually increased. The annual increment in the load is equivalent to about 20,000 lamps of 8 cp and even that increases from year to year. The total works cost in 1905-1906 was 2.578 cents per kw-hour and when interest, sinking fund, etc., were added, it amounted to 4.748 cents. Heating by electricity is gaining ground rapidly in this district, as is evidenced by the fact that electric radiators are now installed in some 300 flats. Energy for this purpose is supplied at a flat rate of 2 cents per kw-hour.—Lond. *Elec.*, March 8.

Booster.—An illustrated description of the use of the Entz reversible booster in connection with a traction storage battery at the Greenock electricity works.—Lond. *Elec. Rev.*, March 1.

Wire, Wiring and Conduits.

Signal Indicating When a Fuse Blows.—An illustrated description of the device of Siemens & Halske Company to give a signal when a fuse has blown. The arrangement is shown in Fig. 4. The conductors *ab* contain the fuses *f1f2*. Each fuse

is connected in parallel with an electromagnet $g_1 g_2$ respectively. The illustration shows the normal conditions. If the current rises above the permitted limit, the fuse will blow, for instance, f_1. The electromagnet g_1 is now energized and attracts h_1. K_1 is thereby released and makes contact with m_1 while simultaneously the contact s_1 is broken. The current in a is therefore interrupted, while a second circuit is closed which contains the battery B. The bell q will therefore ring and give a

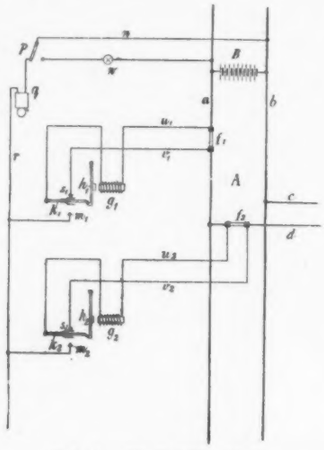


FIG. 4.—FUSE INDICATOR.

signal that the fuse f_1 is blown. By means of the switch p the bell q is now disconnected from the circuit and a new fuse f_1 is inserted. In order to make sure that after the new fuse has been inserted the contact between h_1 and k_1 is again made, the lamp w is provided. When burning it indicates at once that the apparatus has not yet been properly reset.—*Zeit. f. Beleucht.*, February 28.

Fastening Insulators.—Egner.—An illustrated article on a new method for fastening an insulator to its support. The feature is the use of insulating caps which consist of extra strong durable paper impregnated with insulating material. These insulating caps are placed to the requisite number upon the support, one upon the other, and are pressed together by hand and the insulator is then screwed on while simultaneously pressed against the support. The paper is thus made to quite fill the space between the support and the inner threaded part of the insulator. It is recommended to put some drops of oil which will not become rancid, inside the insulator, before screwing it on. It is claimed that the insulation is greatly improved by this method.—Lond. *Elec.*, March 8.

Drop in Alternating-Current Lines.—Mershon and Fowler.—A reprint of an article by Mershon on this subject from the *American Electrician*, with some supplementary notes by Fowler giving concrete numerical examples on the use of Merchon's table and diagram.—*Elec. Journal*, March.

Electro-Physics and Magnetism.

Rays.—J. J. Thomson.—An account of the first three lectures out of a course of six on "Roentgen, cathode and positive rays." The first lecture dealt with the more familiar characteristics and properties of Roentgen rays, and included the theory of their generation by the sudden stoppage of the cathode rays by the target in the focus tube. The second lecture advanced to the consideration of secondary radiation, and was concerned more particularly with the relations between the atomic weight of an element and the secondary radiation it yields. This relation can be briefly expressed by saying that with increasing atomic weight there is increasing secondary ionization under the stimulus of Roentgen rays; and again, that the secondary radiation from any particular metal penetrates other metals the more easily the nearer their respective atomic weights are to its own. There is only one exception to these experimental laws, and that is the case of nickel, that prompts the suggestion that the atomic weight of nickel is really somewhat different from the value reached by chemical investigation, and is larger than that of cobalt. In the third lecture the most interesting point was the description of Lorentz's recent analysis of the radiation from metals. The flying electrons in metals are continually colliding with the atoms, thus generating Roentgen rays. An acoustical analogue is a roomful of carpenters hammering vigorously. Now by Fourier's theorem, any noise, however horrible, can be produced by the superposition of properly selected and graded musical notes. The selection of the proper notes is called harmonic analysis. Thus the roomful of carpenters can be mathematically replaced by a roomful of tuning-forks. Lorentz has done this, and has calculated the share of the energy contributed by the larger tuning-forks. The result agrees very remarkably with the established laws of the heat radiated from hot bodies. Thus it appears that all thermal radiation is, in its original, Roentgen radiation. The lecturer touched upon a feature of quite different interest when mentioning the physiological effects of Roentgen rays. He pointed out that the sores due to Roentgen rays, being skin sores, must be produced by the most easily absorbable rays from the tube. He suggested that it might not be difficult to find a substance that would filter out these easily absorbed rays and leave for use the innocuous penetrating rays that alone are needed in surgical application.—Lond. *Elec. Eng'ing*, March 7.

Radioactivity.—Lord Kelvin.—"An attempt to explain the radioactivity of radium." One chief action is the shooting out of electrons from the non-electrified solid or liquid body. The author has formerly explained the plan of an atom by the assumption of mutual force in the line between the center of the atom and an electron anywhere within it; according to this there is for the electron one position of stable equilibrium near the boundary of the atom with very small potential energy; and another position of stable equilibrium at the center of the atom, with very great potential energy. He calls the atom loaded when it has an electron at its center and he calls the atom unloaded when there is not an electron at the center. In a crystal of bromide or chloride of radium the radioactivity may be assumed to depend primarily on the raidum atoms in the compound. If we suppose that at a moment every radium atom be unloaded within the crystal, then in a very short time of progress towards equilibrium of kinetic averages some of the atoms will become loaded and in time a greater and greater proportion will become loaded until a permanent average of loadings and unloadings will be reached. The energy of the work done in loading the radium atoms is taken from the energy from thermometric heat in the crystal. A cooling is thus experienced by the crystal, until heat conducted and radiated in from the surrounding matter compensates the cooling effect of the loadings and a permanent equilibrium of temperature is reached. A certain definite proportion of all the loaded atoms will become unloaded every second. Electrons will be projected out of these atoms with enormous velocities and the exciting cause of this atomic "discharge" or "explosion" is a shaking of the electron from its stable equilibrium in the center far enough out to get beyond the range of stability and to be expelled away by repulsion. Those electrons which are thus shot out of the crystal are the beta particles. On the other hand those of the discharges of loaded atoms which send the electron inwards, relatively to the crystal, will, by the recoil, force the unloaded atom outwards; and if it is near enough to the surface of the crystal it will be sent out into the surrounding space with comparatively small velocity and energy. The unloaded atoms, being positively electric, constitute the alpha radiation. The alpha radiation will generate comparatively little heat in being brought to rest by the resistance of the matter outside the crystal. The generation of heat by the electrons which are shot out will be much greater because of their much greater kinetic energy. This process can go on forever without violating the law of conservation of energy and without any monstrous or infinite sort of potential energy in the loaded radium atom. The shooting out of electrons with prodigious velocities generates heat locally in the material around the

radium crystal; while heat is taken into the crystal by conduction and radiation to supply the energy for the continued loadings of unloaded radium atoms. The author emphasizes by italics the importance of the ***radiation*** of heat from the outside to the radioactive atom.—*Phil. Mag.*, March.

Units, Measurements and Instruments.

Magnetic Tests.—TAYLOR.—In a continuation of the author's illustrated serial on the standardizing laboratory, a zero method for magnetic tests is described. The general plan of operation is to set up opposing e. m. f.'s simultaneously in the secondary of a standard solenoid and in a search coil which cuts the magnetic field being explored. One terminal of the search coil and of the secondary are joined together. A ballistic galvanometer is connected to their other terminals, forming a closed circuit. The number of turns in the secondary of the solenoid can be adjusted until the opposing impulses are equal as indicated by the absence of deflection in the galvanometer. The purpose for which the outfit is most used by the author is that of measuring the strength of permanent magnets of the horseshoe type, having narrow air-gaps. The connections for this class of work are shown in Fig. 5. For other similar kinds of

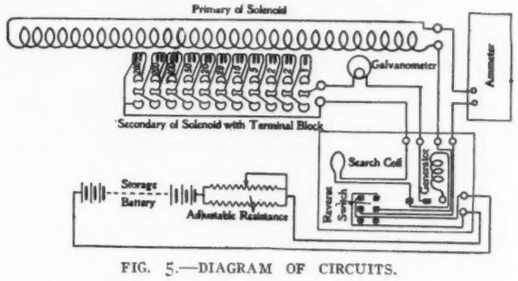


FIG. 5.—DIAGRAM OF CIRCUITS.

testing the only modifications necessary are in the design or arrangement of the search coils and primary switches. There are 11 separate secondary coils in the solenoid, of 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, and 200 turns, respectively. Any coil can be connected in or omitted from the circuit according to the position of its plug on the terminal block. No coil is ever short-circuited; otherwise the manner of connecting secondary coils in circuit would be the same as for resistance coils in the old "post-office" resistance boxes. Figures are given on the design and range of such an instrument. A galvanometer stopping device is then described. It is necessary since, if one had to wait for the galvanometer to come to a stop without help after each trial adjustment the time consumed would be prohibitive. For the purpose of bringing the galvanometer quickly to rest after a deflection, a small generator is connected through a key to the galvanometer circuit. The key is pivoted at the middle. In its normal position it leaves the galvanometer circuit open. The generator consists of a permanent magnet with a variable air-gap. This air-gap is surrounded by a coil of wire and is shown diagrammatically in Fig. 6. The width of the

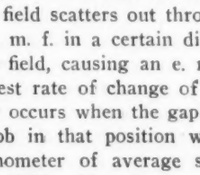


FIG. 6.—AIR GAP.

air-gap is varied by means of a knurled-head screw. As the gap widens the magnetic field scatters out through the surrounding coil, setting up an e. m. f. in a certain direction. Closing the gap concentrates the field, causing an e. m. f. in the opposite direction. The highest rate of change of magnetic flux for a given speed of screw occurs when the gap is narrow. A quick half-turn of the knob in that position will turn the moving element of a galvanometer of average sensibility through a complete revolution. With wider air-gaps the rate of change is lower, allowing accurate control over small deflections. The instrument is not suitable for a shop method of testing magnets but rather for checking the permanence of standards used in shop methods. The magnets to be tested are of a variety of forms and sizes but all have air-gaps narrow enough to permit a comparatively small coil to encircle the entire field. They are placed on top of the box in such a position that the search coil, when raised, will encircle the field. Magnets of such a shape that they can be quickly placed in the proper position with relation to the search coil and which do not vary more than 150 per cent from minimum to maximum strength can be tested at the rate of about twenty per hour. At that rate there is no difficulty in duplicating results repeatedly within 0.5 per cent. The instrument has also been used for the measurement of hysteresis of hard steel bars; distribution of field in large electromagnets; total field cut by the coil of a direct current instrument in swinging throughout its working range. The auxiliary apparatus used in measuring hysteresis consists of a magnetizing coil having a hollow core large enough to admit the sample bar and leave room for a search coil to slip freely over it between the coil and the sample.—*Elec. Jour.*, March.

Cathode Ray Tube for Magnetic Tests.—MADELUNG.—An illustrated article on some new applications on the Braun cathode-ray tube for determining magnetic and dieletic hysteresis. Angstrom has formerly described such applications, but the arrangement of the present author is somewhat different. In the Braun cathode ray tube the ray is magnetically deflected so that when it impinges on a fluorescent screen a fluorescent curve is obtained. The object may be, for instance, to get in this way directly the *I-H* curve which is the ordinary magnetization curve, *I* being the intensity of magnetization and *H* the field intensity. It is also possible to get the *B-H* curve where *B* is the magnetic induction. The *I-H* curve can be obtained by the means of the connections shown in Fig 7. The magnetizing (alternating or oscillating) current flows through

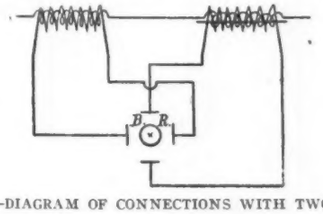


FIG. 7.—DIAGRAM OF CONNECTIONS WITH TWO COILS.

two coils in series, each of which is provided with a secondary winding. One of the coils contains the iron to be tested. Connections are made as shown to four plates which thereby become electrostatically charged and deflect the cathode ray in the Braun tube *BR*. The potentials of these pairs of plates which produce the deflection are proportional to the e. m. f.'s induced in the secondary windings. These are in one $a \frac{di}{dt}$ and in the other $b \frac{di}{dt} + b_1 \frac{dI}{dt}$. The value of the coefficients a b and b_1 depends on the dimensions of the coils and of the iron rod tested. It is always possible to make b sufficiently small so that the potentials which produce the deflection are proportional to $\frac{dH}{dt}$ and $\frac{dI}{dt}$. The fluorescent point in the Braun tube therefore gives directly the desired curve. By means of a third

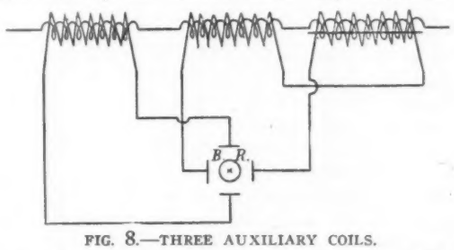


FIG. 8.—THREE AUXILIARY COILS.

auxiliary coil the coefficient b may be entirely eliminated as shown in Fig. 8. The Braun tube may also be used for elec-

trostatic researches, for instance for plotting the curve giving the relation between field strength and dielectric polarization. An electrostatic curve corresponding to the one obtained in the preceding magnetic tests is obtained by the arrangement of Fig. 9 in which two condensers are connected in parallel and used in combination with resistances. In the air gap of one

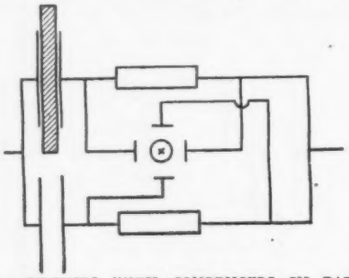


FIG. 9.—CIRCUITS WITH CONDENSERS IN PARALLEL.

condenser the dieletric is placed which is to be tested. Some results obtained by these methods are described.—*Phys. Zeit.*, February 1.

Alternating Current Voltmeter.—An illustrated description of a sensitive alternating current voltmeter for small voltages, independent of frequency and dead beat. The right-hand diagram in Fig. 10 illustrates the principle of the instrument, the

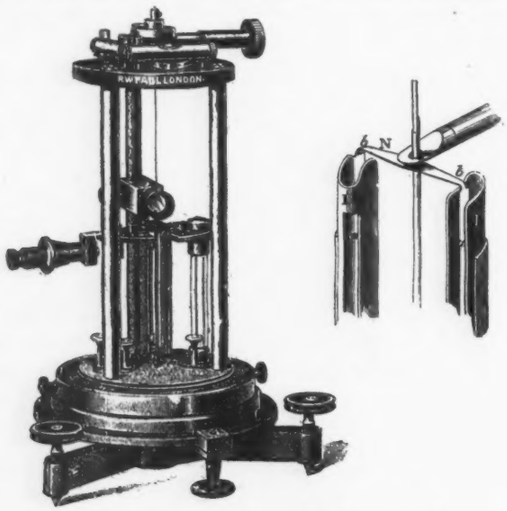


FIG. 10.—ALTERNATING CURRENT VOLTMETER.

working parts of which comprise two, fixed inductors, marked 11, so formed as to leave a cylindrical air gap into which the suspended needle *N*, which is suspended co-axially with them, may be attracted. The needle is formed of two very thin aluminum vanes, *bb*, also shaped into segments of a cylinder, and bolted to the vertical staff. Both the needle and the inductors are made of aluminum, and great care is taken to bring them into similar physical conditions, so as to eliminate the error due to contact difference of potential. As shown in the left-hand diagram, the inductors are mounted on a metal platform carried on insulating glass or amber pillars, and are connected to one terminal of the instrument. The needle is suspended and connected by a phosphor-bronze strip to a torsion head, on turning which the zero may be adjusted without opening the case, the torsion head being provided with a tangent screw adjustment for this purpose. The mirror is shielded by a brass tube from outside electrostatic influence, and, by attaching a light vane to the mirror and enclosing it, the movement of the needle may be heavily damped. Surrounding the working parts shown in the illustration and connected to them, is an inner case which shields the whole from external electrostatic attractions, while an outer case, through which the terminals pass with air insulation, protects the whole. The readings on the scale are proportional to the squares of the pressures on the terminals. By means of non-inductive shunts the instrument is made capable of reading small alternating currents of any frequency. Various ranges are made for pressures from 1 to 7 volts, 4 to 30 volts, 8 to 60 volts.—Lond. *Elec. Rev.*, March 1.

Phase-Meter.—Lori.—An illustrated description of a phase-meter of alternating currents. It depends on the use of an indicator which shows when two currents are in phase. With such an indicator and with the possibility of advancing or retarding the phase of one current by known angles by inserting resistances and capacities it is possible to bring the two currents into phase and thus to determine the original phase difference. The principle of the instrument is shown in Figs. 11 and 12.

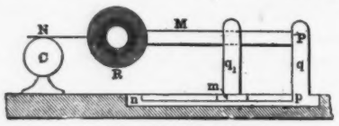


FIG. 11.—PHASE-METER.

In Fig. 11 a coil *R* is carried on a flat spring, *M*, fixed at *P*, and passing through a slot in q_1. By moving q_1 towards or away from *q* the natural period of the vibration of *R* can be made to correspond with the period of the current. As shown in Fig. 12 *R* is placed between corresponding poles of two electro-magnets, and consequently in a radial field, and when carrying an alternating current will oscillate along the axle. The position of q_1 is adjusted till the movement is a maximum. The author states that he has obtained an amplitude of 1 cm with a current of 1 milliampere, and anticipates much better results from a new apparatus under construction. As shown in Fig. 11 the coil carries a needle *N*, which rubs lightly on the surface of a cylinder *C*. This cylinder is of insulating

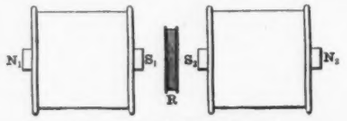


FIG. 12.—PHASE-METER.

material, but carries a very narrow silver ring sunk into it in the mean position of the needle, so that the needle when at rest makes steady contact with the ring, and when vibrating makes momentary contact twice in each complete oscillation. Now, if two such pieces of apparatus carry alternating currents of the same period and in phase with one another, and the needle contacts be placed in series in the circuit of a telephone, then the telephonic circuit will be completed twice in each oscillation, and a sound will be heard in the telephone. But if the two currents are not in phase the two needle contacts will never be completed simultaneously and no sound will be heard. Fig. 13 shows the connections of a pair of such pieces of appa-

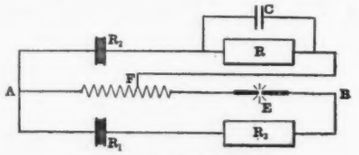


FIG. 13.—PHASE-METER.

ratus, the moving coils, R_1, R_2, alone being drawn. To determine the phase difference between the current and the e. m. f. of the arc lamp, the resistances *R*, R_3, are adjusted until the movements of R_1, R_2, are in phase, when the telephone will sound.—From *Il. Nuovo Cimento;* abstracted in Lond. *Elec.*, March 8.

Railway Signals.—A fully illustrated description of a new system of railway signalling, in which audible signals on the locomotive itself are controlled electrically from the signal-box. It has been developed by the Great Western Railway, and installed on a branch line. A third rail a few yards long is provided at each signalling point, with which contact is made by a shoe on the locomotive. When the signal "clear" is to be given, the current picked up causes a bell to ring on the locomotive but if the contact rail is not connected to the battery in

the signal-box, the plunger carrying the contact shoe is caused to interrupt a local circuit and release a whistle valve, which is normally held closed.—Lond. *Elec. Eng'ing,* March 7.

Brake for Testing.—A fully illustrated description of an eddy current brake for testing small motors made by a British company.—Lond. *Eng'ing,* March 8.

Notation.—Brunswick.—A communication to the International Society of Electricians in Paris proposing a system of conventional signs or standard symbols to represent electrical apparatus and installations in drawings.—*L'Ind. Elec.,* February 25.

Miscellaneous.

Human Side of the Engineering Profession.—Karapetoff.—Professional usefulness and personal satisfaction depend on the right conception of life and on the degree to which this conception of life is manifested in daily activity. There are three essential requisites for an efficient and successful engineer; sound professional knowledge; knowledge of business forms and of human relations, and a good and strong character. The true purpose and value of engineering activity lie in providing better, easier ways for satisfying ordinary human needs. This provides more leisure and opens new possibilities for a higher spiritual and intellectual development of humanity. The engineer's personal satisfaction consists in knowing this high purpose of his vocation and in giving his services at a maximum efficiency. The other compensation is a result and not the purpose.—*Elec. Journal,* March.

Organization of Manufacturing Plant.—Horsnaill.—A long article giving a plan for the organization of machinery manufacturing works with a scheme for the necessary records and forms to suit. He suggests some departures from the organizations usual in such works in the direction of more complete departmentalization and subdivision of the executive management.—Lond. *Elec. Eng'ing,* March 7.

Electric Industries in Austria.—Honigmann.—The first part of an article on the present condition of electrical industries in Austria-Hungary with reference to proposed changes in tariff and their effect on imports and exports and manufacture.—*Elek. Zeit.,* March 7.

BOOK REVIEWS.

The Slide Rule; A Practical Manual. 10th Edition. By Charles N. Pickworth. Manchester: Emmott & Company, Ltd. 104 pages, illustrated. Price, $1.

The fact that ten editions of this book have been published demonstrates its practical value. The mechanical and the mathematical principles involved in the application of the slide rule are clearly and concisely stated, enabling a student of the subject to grasp the fundamental principles in a way that forms a reliable foundation for the superstructure to be reared by an extended study of the following pages. Numerous examples are given and explained which cannot fail to make the operation of the several types of slide rules very plain to the student seeking after knowledge along this line.

Elements of Gas Engine Design. By Sanford A. Moss. New York: D. Van Nostrand Company. 197 pages, illustrated. Price, 50 cents.

This is No. 121 of the well known Van Nostrand Science Series. The object of the book is to present in attractive and useful form the fundamental principles with which the designer of gas engines ought to be familiar in order to thoroughly understand this important subject. The author has a faculty of presenting the data and giving concise reasons for his conclusions that add much to the value of the work.

This book will not only be valuable to the rather small class of men engaged in designing gas engines, but also to the large number who operate these engines in various industries. When a man thoroughly understands the design and construction of the engine that he operates, he is in a good position to keep it in repair and readily discover the cause of any defect which prevents it from starting or running smoothly.

A large proportion of the trouble with these prime movers has been caused by ignorance on the part of the operators of the details of construction; hence when a work such as this is presented that aims to give and does impart to careful readers the required information in comprehensive form, it is worthy of recognition by gas engineers and owners of plants of various kinds operated by gas engines.

The Dangers of Municipal Ownership. By Robert P. Porter. New York: The Century Company. 356 pages. Price, $1.80, net.

This interesting and timely volume, to which attention has already been called briefly in these pages, should be in the hands of all central station managers confronted with the problems of municipal ownership agitation, and of all who study such questions. Mr. Porter gives a brief history of the upgrowth of municipal "trading" in Great Britain, and discusses it also in its various aspects in Russia, Australasia and other parts of the world. Particularly interesting are the chapters that tell the dismal tale of the manner in which the electrical industries of England were checked, and in which, for example, electric lighting was well-nigh crushed out of existence because it might hurt the municipal gas plants. Some cogent data are also presented as to the results of telephonic operation by private enterprise and under governmental or municipal control. A typical illustration of what has happened in England is given in the summary of affairs in Poplar, where 15 minor mechanics and petty tradesmen, not one of whom paid taxes, had the spending annually of $1,000,000 raised by the rates. And they spent it! No wonder the recent elections in London went the way they did, throwing out of the saddle those who have been riding a socialistic hobby to destruction and bankruptcy.

Boiler Waters. By William Wallace Christie. New York: D. Van Nostrand Company. 235 pages, 77 illustrations. Price, $3.

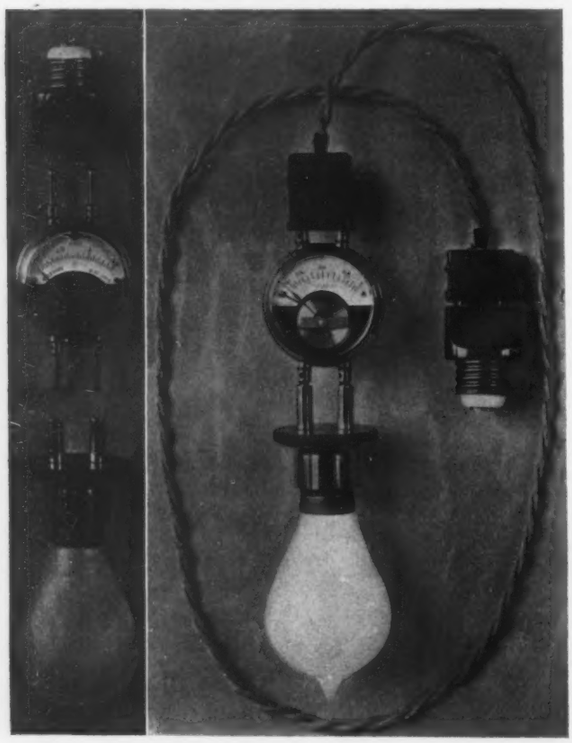
A carefully prepared comprehensive work on the subject of feeding steam boilers, keeping them clean and preventing corrosion which causes so many failures of boilers under pressure, resulting in loss of life and property. Reports of the analysis of waters containing many different kinds of impurities are given, and as many of them must of necessity be used to feed boilers, these reports enable the competent engineer to take measures that partially or wholly counteract the bad effects of these impurities. Study of this book will convince even the most skeptical of the need of water softening and purifying apparatus, as securing both safety and economy in the operation of steam plants.

The difference between scale and sediment is clearly stated, also the fact that scale is not such a poor conductor of heat as it is sometimes supposed to be. It is admitted, however, that thick scale may cause plates to be burned. The danger of using water that is commonly called "too pure" is also pointed out, as it results in pitting of tubes and other parts. Attention is called to the great danger of ruining boiler plates by allowing even a very small portion of the oil fed to engine cylinders to enter the boilers with the feed water. Oil that thus finds its way into a boiler is distilled and the deposit is a very efficient non-conductor of heat, causing plates to be overheated and badly burned. This caution should be made to apply to animal and vegetable oils, as there is little danger in this respect from the use of mineral oil. Boiler insurance companies might with benefit to themselves and their patrons insert a rigorous clause in their policies prohibiting the use of any other than mineral oil in the cylinders of engines and pumps, the condensation from which passes, or is ever likely to pass, in whole or in part, into boilers. The use of blended cylinder oils should be avoided, for they consist merely of mineral oil, which is cheap, adulterated with small quantities of higher-priced animal or vegetable oil which render the blend obnoxious for cylinder use, though it may sell at twice or more the price of the mineral oil base, which the additions spoil rather than improve.

German Portable Incandescent Lamp Testing Instruments.

A number of interesting instruments for measuring current and potential have recently been developed in Germany for testing incandescent lamps.

The accompanying illustration, Fig. 1, shows a new design of



FIGS. 1 AND 2.—LAMP AMMETERS WITHOUT AND WITH CORD.

aperiodic, three-coil, incandescent, lamp-testing instrument for direct current reading from zero to 1.5 amperes and with a voltage up to 150. This pocket instrument has a resistance of .25 ohm and weighs only .44 pound. Fig. 2 shows a similar instrument with flexible cord attached but of the electro-magnetic type designed for use on either alternating or direct

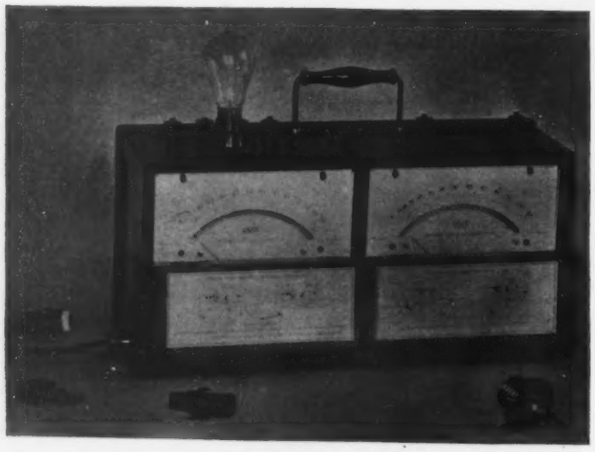


FIG. 3.—HOT WIRE LAMP AMMETER AND VOLTMETER FOR DIRECT AND ALTERNATING CURRENTS.

current circuit. This instrument has a range of from .2 to 1 ampere and from 30 to 150 volts; its weight is only .33 pound.

The instrument shown in Fig. 3 is of the hot-wire type with two scales for reading both the current and the voltage, the former from zero to 1.5 amperes and the latter from zero to 150 volts. It is designed to operate on either direct or alternating current; its dimensions are 3.4 in. wide, 8.2 in. high and 16.6 in. long. The length of the scales is 3.4 in. and the total weight of the instrument is 16.5 lbs.

These instruments were constructed at Frankfort, Germany, by Hartmann & Braun, and are said to be of great value for central station as well as for isolated plants.

Methods of Feeder Regulation.

In cities where distribution from the main central station is sectionalized in smaller sub-stations fed from the main power house, the maintenance of constant voltage on the numerous feeder circuits is a complicated problem. As the load conditions vary widely on each feeder circuit it is impossible to regulate the voltage for all from the main station. Special feeder regulators must, therefore, be installed if the best service is to be maintained.

There are, in general, three sets of conditions which may result in poor voltage regulation. The first, and, perhaps, the most severe circumstance causing extreme voltage variation is that arising when heavy induction motors are operated on a lighting circuit. The second class of conditions includes those by which there is a more uniform and steady increase and decrease in load with the consequent change in potential at the center of distribution. Such a condition occurs at stations as the evening lighting peak comes on. Under the third head

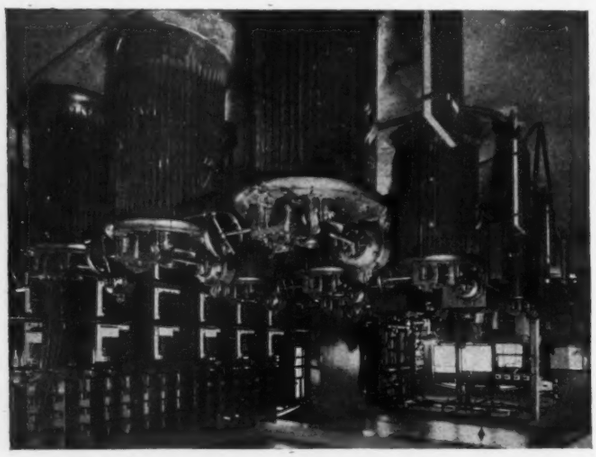


FIG. 1.—INDUCTION REGULATORS IN HYDE PARK SUB-STATION.

come voltage variations due to changing loads at the end of a long transmission line. An example of this is to be found in a hydro-electric station where branch feeder circuits from a common source are subjected to varying loads while at the same time, the bus-bars may be supplying current for a rotary converter for railway work.

For the sensitive regulation of the voltage under the first condition there must be employed a type of regulator which is automatic and very quick in action. Such a type of regulator employing as an auxiliary a contact-making voltmeter will provide a very satisfactory regulation. Where feeders are long and regulation correspondingly poor, definite rules are often made by the central station engineer to the effect that motors exceeding a certain size cannot be used on the feeders. With the installation of a sensitive automatic regulator, however, practically any size motor can be used without seriously affecting the lighting system.

The second case does not demand such quick action on the part of the apparatus. A less sensitive type of regulator operated by hand or remote motor control will meet such conditions, although the necessary attendance may be eliminated by utilizing a governing relay, or contact-making voltmeter to govern automatically the regulator in a manner similar to that employed in the first case.

The third case includes lamp and motor service where the most sensitive type of feeder regulator must be adopted. Only an automatic method of regulation is permissible, because the rapidity of fluctuation in the load can not be compensated for by any system in which the "personal equation" of the operator enters.

The city of Chicago presents an interesting example of the use of feeder regulators in sectionalized inter-connected sub-stations. Power lines run from the main generating station underground to the distributing centers supplying current at a potential of 9000 volts, and a frequency of 25 cycles. Motor-generator frequency-changer sets are installed in each sub-station to transform the 9000-volt 25-cycle current to 4000-volt 60-cycle. The distributing system is three-phase, four-wire, since large blocks of power for lamps and motors are transmitted to considerable distances from the sub-stations. Because the load conditions on these feeders vary widely, it has been necessary to provide proper regulation for the control of the individual feeders. Both an automatic quick-acting regulator and a remote controlled somewhat less sensitive hand operated regulator have been adopted to meet the conditions in this city. These regulators were manufactured by the General Electric Company.

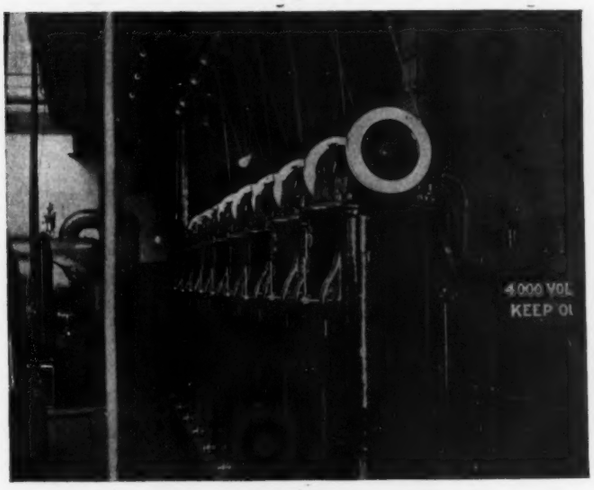


FIG. 2.—INSTALLATION OF NINE REGULATORS.

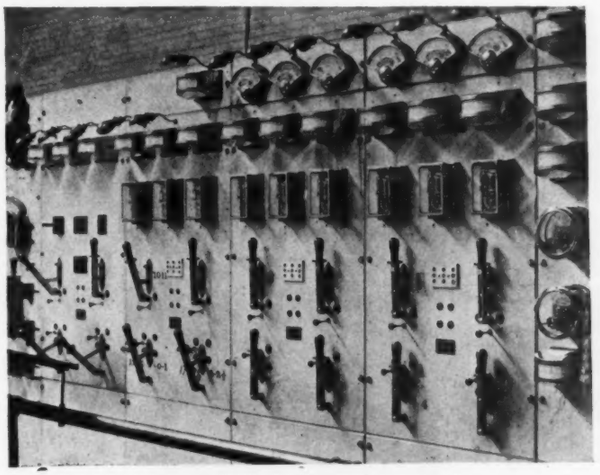


FIG. 3.—CONTACT-MAKING VOLTMETERS.

The use of the feeder regulators in this instance is modified by the introduction of the Tirrill regulator. This regulator holds the voltage on the generator side of the frequency changer sets so uniform that it has been thought unnecessary to introduce the automatic features on the induction regulators. It is naturally desired to compound the voltage for the center of the feeder distribution as the load comes on and this has been accomplished by the motor-driven remote-control type of regulator. While this means of regulation, in conjunction with the Tirrill regulator gives excellent results, it is necessary that switchboard attendants be at hand at all times and watch the potential as the load increases or decreases on the different feeders. Fig. 1 shows an installation of remote-controlled regulators in the Hyde Park sub-station in Chicago.

The power stations in Chicago generate both 25 and 60-cycle current. When the generating units produce a frequency of 60 cycles it is, of course, unnecessary to use frequency changer sets at the sub-stations to supply satisfactory power for the incandescent lighting circuits. In this event, however, the power conveyed on the transmission lines is subject to poor regulation because of the greater line drop to be compensated for. In these sub-stations the quick-acting automatic type of regulator has been found to give excellent results. Aside from the voltage regulation at the busses for which correction must be made, the regulator has to compound for the line drop between the busses and the center of distribution. The adaptability of this automatic type of regulator to meet severe conditions is emphasized by the fact that the Chicago Edison Company has not hesitated to install several motors for elevator work on its lighting feeders.

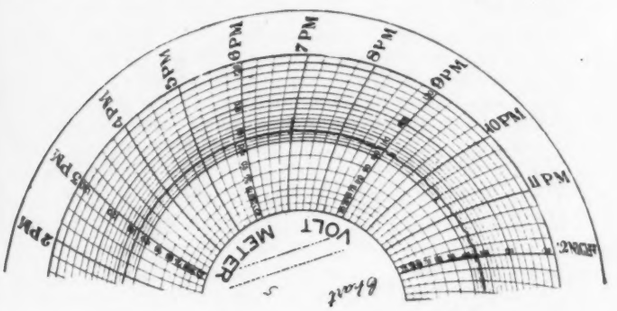


FIG. 4.—VOLTAGE AT THE DISTRIBUTING POINT.

A second example of conditions in which the quick-acting regulator is essential, occurs at Toledo, Ohio. Here, nine regulators are installed, as shown in Fig. 2. The regulators have been in continuous operation for over three years. The neat and compact arrangement of the contact-making voltmeters is seen in the row of glass enclosed instruments directly above the switches shown in Fig. 3. Some idea of the good results attained by these regulators can be gained by a study of the accompanying curves.

At this station is illustrated the advantage of the automatic feeder regulator in compounding automatically for line drop.

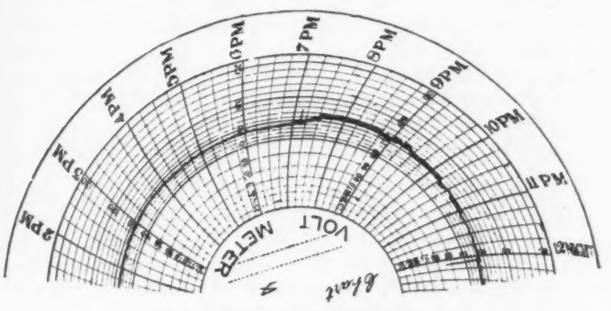


FIG. 5.—VOLTAGE AT THE STATION.

The voltage maintained at an average distribution point, three miles from the station, is indicated by the curve in Fig. 4. The simultaneous reading on the voltmeter at the central station after the current had passed the feeder regulator is shown by curve Fig. 5. It is evident by an inspection of these curves that the regulator maintained a constant voltage at the average distributing point on the feeder during the variation in load between 7 o'clock p. m. and midnight, by boosting the

feeder voltage at the central station to compensate for the line drop.

These particulars as to the operation of regulators at Toledo are abstracted from a paper read by Mr. W. E. Richards before the Ohio Electric Light Association at Put-in-Bay, Ohio, in August, 1905. Mr. Richards further states that before the system was supplied with feeder regulators considerable difficulty was experienced in maintaining anywhere near the proper voltage regulation. The circuit upon which the records shown was made, was on the same phase with a similar circuit, both having heavy park and theatre loads at the extreme end of the line. Moreover, the load differed materially from that on the other circuits, all of which show equally as good a regulation under the control of the automatic regulators.

Singing Arc.

One of the most interesting features of the demonstrations now being given at Telharmonic Hall, at Broadway and Thirty-Ninth Street, New York, is found in the singing arc lamps. The high frequency currents from the various alternators of the dynamophone are superposed upon the normal direct current of the lamp, thus producing variation in the heat emitted

SINGING ARCS.

from the arc. The heat fluctuates in synchronism with the telharmonic currents and produces thereby changes in the air which reach the ear as musical sounds.

The accompanying illustration shows two Excello 10-ampere arc lamps being used as telharmonic receivers. The peculiar quality of the impregnated carbons used in these lamps renders them particularly well adapted for this work.

Heating and Ventilating a Hotel.

The heating and ventilating equipment of the Hotel St. Regis, New York City, is of unusual interest on account of the use of the indirect steam heating system for all public portions and 550 guests' rooms in a building 18 stories in height, direct radiation having been eliminated in all portions except in the servants' dormitory upon the eighteenth floor. For this indirect heating service a number of independent blower systems are used with cheesecloth filter intakes, automatic temperature control on heating stacks and humidifiers for the automatic regulation of the moisture carried in the air. The systems are in all cases designed to maintain, in connection with the exhaust ventilation system, a uniform temperature of 70 degrees Fahrenheit in zero weather, all having exhaust vent connections through register openings or fireplace flues. A feature of the installation is the sub-division of the heat supply to the guests' rooms upon the upper floors, into three nearly equal divisions, each of which is supplied by a heating fan on a floor underneath for upward delivery.

The blowers are all three-quarter-housed steel plate fans, built by the B. F. Sturtevant Company, of Boston, Mass., with top vertical outlets, delivering to overhead lines of duct work, which supply the delivery systems on the floors above. They are located with short direct connections to the tempering coil casings and all have individual motor drives. The motors are all of direct-current type operated from the 220-volt power mains of the hotel electrical distributing system and are equipped with speed-regulating starting rheostats allowing three variations of speed from two-thirds speed to full speed by field control. The motors are all mounted on brick piers and drive the fans through flexible shaft couplings.

Reflector-Stalactite Globe.

The Holophane Company, 227 Fulton Street, New York, has recently placed on the market a new reflector-stalactite similar in construction and application to its well-known "Pagoda" ball which has been used so largely in the public buildings of this country. Fig. 1 shows one of these reflector-stalactites. The

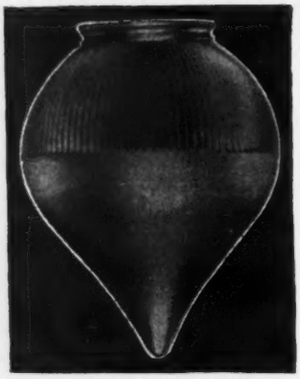


FIG. 1.—REFLECTOR STALACTITE.

upper part consists of scientific prisms, while the lower part is of ground glass, the whole being made in one piece, thereby uniting the qualities of the frosted glass with those of the Holophane prisms. This globe is made for a 3¼-in. holder, has a width of 6 ins. and a height of 7¾ ins. Fig. 2 shows a similar

FIG. 2.—REFLECTOR STALACTITE.

type having exactly the same dimensions in regard to holder and width, but having a height of 10 ins.

When lighted up, the result is very brilliant. The ground-glass bottoms of these stalactites can be cut in a number of different patterns. Lamps of from 16 cp to 22 cp are recommended for use in these globes.

Small Direct-Current Generator and Balancer Sets.

A complete line of direct-current generators ranging in size from 1½ kilowatts to 17½ kilowatts has lately been developed by the General Electric Company. The machines embody the compact cylindrical construction which has been found satisfactory in motors, and are applicable as exciting units for alternators or as generators for small power plant purposes where a low capacity, belt-driven generator is required. The bearing heads are so constructed that the machines can be installed on floor, wall or ceiling, thus adapting the generators to crowded locations. Because of the general compact construction as well as the good quality of the material incorporated, the magnetic circuits

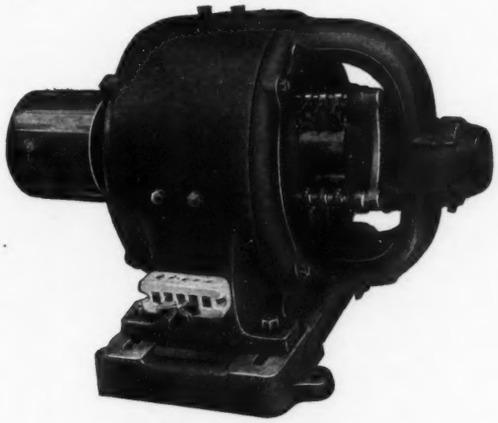


FIG. 1.—GENERATOR.

are short and the iron losses are very low. In this way high efficiencies are obtained for such small generators.

Some constructive features deserve special mention. The field and armature coils are form-wound and removable, and both receive a special insulation treatment which renders the coils practically impervious to water. The field coils are held in position by the flanged tips of the steel pole-pieces, which are seated firmly in the field frame by bolts passing through the frame and secured with nuts. The armature coils are held in toothed slots on the core and extend beyond the end flanges, being banded firmly to prevent vibration or movement. This form of winding gives a large radiating surface for the conductors and so keeps the temperature rise very small.

The bearings are arranged with ring oilers and, as has been

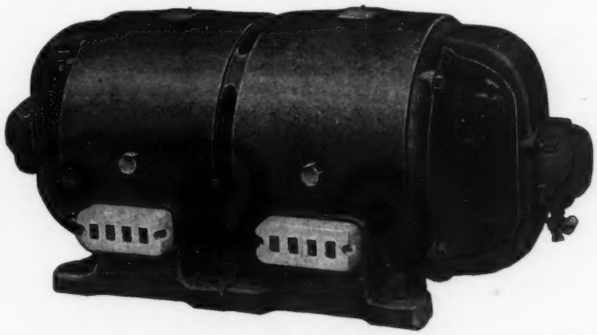


FIG. 2.—BALANCER SET.

mentioned, can be adjusted for wall or ceiling installation by turning the bearing heads through 90 or 180 degrees. Carbon brushes, sliding in finished box guides, are held against the commutator by adjustable individual springs. The generators will operate sparklessly from no-load to full-load, without shifting the brushes. They are compound wound for 120 to 125 volts, and from 240 to 250 volts full load. Conservative ratings are adopted so that the machines will run at full load without undue rise in temperature of any part.

A further development of the generator is the balancer set shown in Fig. 2. For the regulation of three-wire systems, the compactness and simplicity of the new machines make them peculiarly suitable. The outfit consists essentially in grouping two of these generators as one, with both armatures mounted on a single shaft. This elimination of the end shield and the middle bearing reduces to a minimum the floor space occupied by the balancer sets. In operation, one armature acts as a motor and the other as a generator, according to which side of the system has the greater load.

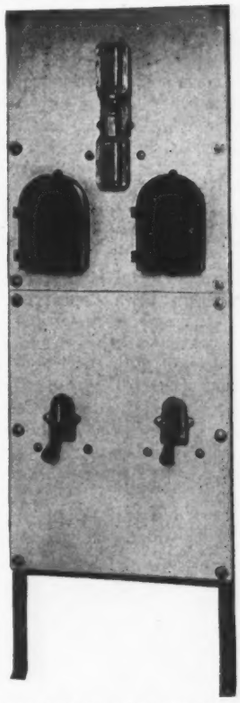
The generator frames are riveted together through space blocks, the common armature shaft being used to eliminate the third bearing. To strengthen the shaft at the point of greatest deflection, an intermediate armature head is mounted between the armatures.

This method of grouping the generators compactly necessitates a somewhat limited amount of air space between the generator frames. Good ventilation, however, is assured by placing on the shaft between the armatures a fan which draws in air through the ventilating spaces and permits as good temperature guarantees as are obtained in the individual generators.

High-Tension Automatic Time Switches.

Automatic time switches for turning lamps on and off at stated times have come into general use, and the convenience and certainty of this method of controlling an electrical circuit have given rise to a definite demand for an oil-break switch of this type for use in controlling high-voltage circuits.

The accompanying illustration shows a solenoid-controlled oil switch brought out by the Hartman Circuit Breaker Company, of Mansfield, Ohio, for automatically throwing on and



AUTOMATIC TIME SWITCHES.

off circuits of any potential up to 3300 volts at stated times each day. The solenoids are operated by current from the secondary of a potential transformer in shunt with the main circuit, and no auxiliary circuit, therefore, is required to open and close the oil switch. The secondary circuit is controlled by means of two Seth Thomas eight-day clock switches, one for the opening solenoid and one for the closing solenoid. The upper panel of the accompanying cut shows 3000-volt oil switches controlled in the manner described.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The spring-like weather stimulated retail trade and was helpful to crops, and among the encouraging features of the week were the cessation of liquidation in securities and the easing of the strain in the money markets. On the other hand, there are some features tending to conservatism as to the future. Collections are still irregular, which is attributed variously to slow deliveries of goods, congestion of farm-product deliveries, and, finally, to the heavily increased volume of past trade. Money is still high in price; a long period of this condition is apparently in sight, and there is a disposition to await a clearer view of the future, and especially the matter of crop prospects, before extensive commitments are made as to the distant future. There is more unrest in labor circles, notably among railway employees and building hands. Talk of retrenchment by railways is still rife but cancellations of orders for rails and other material are so far reported light. The first quarter of 1907 closes with a remarkable record of mercantile activity, despite traffic blockades, severe weather and a violent decline in stocks, the average price of sixty active railway stocks falling to $91.09, against $120.99 at the highest point last year. That this decline was not due to loss of earning power is evidenced by the announcement of dividend and interest payments next month far in excess of any previous April distribution; and railway earnings thus far reported for March were 9.4 per cent larger than last year's. Manufacturing plants are fully occupied in most leading industries, except where a strike or the scarcity of labor renders machinery idle, as at some Eastern textile mills, while the supply of wage earners is being augmented by extensive immigration, 65,541 aliens being admitted in February. Bank exchanges at New York for the week were 19.9 per cent larger than last year, and at other leading cities the average gain was 15.5 per cent. There was less firmness in the prices of some metals, copper principally, but iron prices were held firmly by the deadlock between buyers and sellers as to distant months. A somewhat remarkable feature in the general market was the reported offering, at an attractive price, of 5000 tons of basic pig made in China. The paucity of steel in the central west continues. In finished lines the situation is strong. A large demand for structural material is in sight. Steel-car builders are freely specifying on plate contracts. Traction interests furnish the bulk of the new business booked in the steel-rail line. Copper was weaker, with business quieter, as buyers appear disposed to hold aloof until conditions abroad and at home become more settled. The closing quotations are 25 cents for Lake; 24¾ cents for electrolytic and 24 cents for casting stock. *Bradstreet's* reports 166 business failures during the week ending March 28. The number in the week previous was 157. Compared with the record of the corresponding week last year there was a decrease of 3.

A LABORATORY EQUIPMENT.—The new Electrical Engineering Building of Worcester Polytechnic Institute, which is to be completed this fall, and which will be the largest one of its kind in the country, costing over $125,000, is to be equipped with a complete heating and ventilating outfit supplied by the Green Fuel Economizer Company, of Matteawan, N. Y. The general laboratory is 200 ft. long by 50 ft. wide, containing three galleries, 19,400 sq. ft. of floor space and about 400,000 ft. of cubic contents. Besides this, there will be in the west wing a lecture hall for seating 300 persons, above which will be standards and research laboratories, while the east wing will contain a library and offices, designing rooms, blue print rooms and recitation rooms. The equipment for supplying warm air to this space will consist of a Green cone fan, 6 ft. in diameter, drawing the air through a tempering coil consisting of six Green heater sections, each containing 2544 lineal feet of pipe. The air from the fan can pass either directly to the rooms or through another heater consisting of four sections and containing 2640 lineal feet, or part of the air may be passed one way and part the other and the two volumes of air mixed in suitable proportions to regulate the temperature. The heaters are of a new design, being made up of straight pipe expanded into headers. By removing the covers of the latter, any pipe can be inspected, cleaned or removed. As circulation is positive the heater cannot become air bound. It is adapted for live or exhaust steam and hot or cold water.

MAINE WATER POWERS.—The recent fight to prevent the lowering of the waters of two of the Rangeley lakes has started an agitation in Maine which may result in the holding of the forest and water reserves in trust for the people. The proposition is to have the Legislature create a commission to consider the subject of water storage and its utilization by dams at the inlets of Moosehead, at Magalloway and on the Kennebec. It is proposed that this commission be given until next October to make its report, at which time an extra session of the Legislature be called to consider the recommendations made. The claim is that Maine should do substantially what New York has done, hold its own forest and water power within its own control. Maine has 2300 square miles of water carried in 620 lakes. It is argued that by co-operative state control it will be possible to diminish the waste of evaporation and regulate the flow so as to prevent the wastage of freshets, promote the interests of lumber men and manufacturers, as well as the development of power plants, and justify the superiority of co-operation over the present system.

A WESTERN ELECTRIC BRANCH.—According to the Harrisburg, Pa., newspapers, by May 1 a large new building which the Western Electric Company is erecting on Paxton Street will be completed and Harrisburg will be in possession of a new industry. As soon as the building has been turned over to them the company will make use of it by using part of it as a warehouse and the remainder as a branch of the main office in Chicago. The equipment which will be used in the new plant has already been shipped from Chicago and is on its way. The new building is 113 ft. on Paxton street and has a depth of 140 ft. Harrisburg was selected as a branch owing to its excellent railroad facilities and because the city is the headquarters of the Pennsylvania Telephone Company.

TELEPHONY IN BRAZIL.—The Brazilian Review states that the President of the State of Sao Paulo has signed a decree granting to Senhor Candido José da Silveira the right to establish, use, and enjoy a telephone line linking up the city of Amparo to those of Itapira, Mogy-Mirim, Espirito Santo do Pinhal, S. Joao da Boa Vista and S. Joao do Rio Pardo. The concession is granted for twenty years, the work must be commenced within one year, and the inauguration of the line must take place within two years, while if communications are interrupted for more than three months, consecutively, after the inauguration the concession will lapse.

TELEPHONES FOR EUROPE.—The consular reports of the Department of Commerce and Labor, Bureau of Manufacturers, note the following request: "No. 842. Telephone System.—A firm of Europe wishes to correspond with some American telephone supply company with the object of installing an American telephone system in the country in question. To accomplish this a concession from the Government would be necessary, which the firm claims can be obtained."

MEN NEEDED IN PITTSBURG.—Among the many Pittsburg business houses to make a change in address on April 1 is the local branch of Hapgoods, which removed from the seventh floor of the Park Building, Fifth and Smithfield Streets, to larger and more convenient quarters on the eleventh floor of the same building. This change is made necessary by the increasing demand for high-grade business and technical men of all classes in the Pittsburg district.

PLANT FOR EXTRACT WORKS.—The Juniata Oak Extract Company, Mount Union, Pa., is installing an electric plant to operate and light its works. The equipment consists of a 35-kw General Electric generator, one 25-hp motor, two 4-hp motors, Buckeye engine and about 150 lamps. John L. Dickson has charge of the work.

THE UNION SWITCH & SIGNAL COMPANY is now making a number of improvements to its plant at Swissvale which, when completed, will practically double the productive capacity of these works. During the last year, the company's business has increased to such enormous proportions—its earnings having been 47 per cent on a capital of $3,000,000—that the management found itself greatly handicapped for room, and as the orders during the last few months have continued to demonstrate the permanency of this increasing business, the directors purchased recently thirty-four acres of land adjoining their plant for the purpose of adding to the shops. The company has decided to grade ten acres of this plot at once. Switching tracks will be put in, which will be of immediate advantage, and the lumber yard will be removed to the new site. This will give the management much needed room on the old factory property, and the removal of the lumber from close proximity to the buildings will eliminate fire risks. Plans are now being drawn for a new building to contain a foundry, a blacksmith shop, and a power house, and when these structures are completed the company will have 140,000 additional square feet of floor space for manufacturing purposes. The business of the company increased last year 70 per cent over that of the preceding year, and from present indications the company will do a business this year approximating $10,000,000. The Union Switch & Signal Company is the oldest concern in the country manufacturing railroad safety appliances.

PETROLEUM PRODUCTION.—The U. S. bureau of census reports petroleum refining as part of the census of manufactures. In 1905 there were 104 petroleum refineries in operation. Their total capital was $136,280,541; they employed 16,770 wage earners; paid in wages $9,989,367; used materials costing $139,397,213, and manufactured products to the value of $175,005,320. As compared with the totals for the industry at the census of 1900, these figures represent increases as follows: In number of refineries, 38.7 per cent; in capital, 43 per cent; in number of wage earners, 37.5 per cent; in amount of wages paid, 48.7 per cent; in cost of materials, 35.5 per cent, and in value of products, 41.2 per cent. The principal products, together with the value of each, were as follows: Burning oils, including the different grades of both illuminating, and fuel oils, $100,571,825; residuum, $5,138,361; paraffin oils, $6,216,279; paraffin wax, $10,007,274; reduced oils, $16,794,789; naphtha and gasoline, $21,314,837; neutral filtered oils, $1,942,153, and "all other products," which include coke, carbon points and black naphtha, $15,025,802. The total volume of refined products for which quantities were reported in 1905 was 50,638,490 barrels of 50 United States gallons each. This included 34,344,522 barrels of burning oils and 5,811,289 barrels of naphtha and gasoline, the former product representing 61 per cent of the total quantity and the latter 10 per cent. These classes also included the principal products when rated by value, forming respectively 57.5 and 12.2 per cent of the total.

ALBERGER PUMP COMPANY, 95 Liberty Street, New York City, has been organized to make and sell centrifugal and turbine pumping machinery. The officers, management and works of the new enterprise are identical with those of the Alberger Condenser Company. This apparatus has been designed especially to meet the demand for a higher class of work and more economical performance than has heretofore been attained. It is prepared to build centrifugal and turbine pumps of all capacities and for operation against any head, either steam power or electrically driven. There are very few instances in which these pumps are not desirable substitutes for the old-style reciprocating pumps. The steam turbine has taught the great principle of dealing directly with rotary motion, and it is evident that future progress in pumping lies along this line. The intention is not to build the cheapest pump, but the best; not a pump made by assembling stock parts, but one built for the specific use to which it is to be put; not a pump from cut-and-try obsolete patterns, but from new ones in the design of which every point has had mature consideration.

DEVELOPMENT IN BRAZIL.—What is recognized as a signal victory in the development of South America, is the fact that the Government of Brazil has just granted permission to Messrs. Guinle & Company, of Rio de Janeiro, to sell electricity in the capitol city as well as other important cities in the republic. The contracts for light and power in Nictheroy and other cities along the proposed transmission lines have already been let. The initial electric power sources will include several hydro-electric stations just being completed on various water falls controlled by Guinle & Company. These have an aggregate capacity of some 50,000 horse-power. The electrical equipment was furnished by the General Electric Company of New York. It is expected that work on the transmission lines will be started next June.

KERN RIVER POWER PLANT.—The new powerhouse of the Edison Electric Company of Los Angeles, Cal., on the Kern River, is nearing completion. The initial electric generating equipment provides for an output of some 20,000 kilowatts. The power will be transmitted by pole lines to Los Angeles and to Santa Barbara. Four General Electric Company 5000 kw, 3-phase, 50-cycle generators have been installed. These large machines are water-wheel driven at 250 r. p. m. delivering current at a potential of 2300 volts to the secondaries of the transformers. Each of the thirteen transformers has a capacity of 1667 kilowatts, the primaries being arranged with taps to provide for Y connections at several different potentials, the highest being 75,000 volts and the lowest 33,000 volts. The secondary windings are arranged for delta connection at 2300 volts.

ELECTRIC VENTILATORS.—Numerous sales of electric propeller fans ranging from 18 inches upwards are reported by the B. F. Sturtevant Company, of Boston, Mass., as follows: Bagley & Sewall Company, Watertown, N. Y.; Phœnix Manufacturing Company, Eau Claire, Wis.; The Hermit Club, Cleveland, O.; Beech Nut Packing Company, Canajoharie, N. Y.; Coe Manufacturing Company, Painesville, O.; Chandler Investment Company, Atlanta, Ga.; Armour Packing Company, Kansas City, Mo.; Delong Amusement Corporation, Pine Beach Va.; Syracuse Heater Company, Syracuse, N. Y.; Sheuerman Bros., Des Moines, Ia.; Rice, Barton & Fales Machine and Iron Company, Worcester, Mass., and Thomas G. Plant Company, Jamaica Plain, Mass.

ELECTRIFICATION OF RUSSIA.—It is stated that work on the ten contracts which the Westinghouse Electric interests secured last year from the municipal authorities of St. Petersburg, covering the electrification of the first section of the tramway system of that city is being rapidly pushed, and that the contracts will be completed very nearly on schedule time—by the last of September next. The contracts covering all the work necessary for the completion of this first section amount in the aggregate to $5,500,000. In connection with this contract the Westinghouse Electric & Manufacturing Company formed a Russian company which has acquired a complete establishment at Moscow to manufacture the greater part of the apparatus required.

ELECTRO-METALLURGICAL GROWTH.—The Electro-Metallurgical Company, of 157 Michigan Avenue, Chicago, incorporated about six months ago, has begun the manufacture at Niagara Falls, N. Y., of high-grade ferroalloys, principally ferrovanadium, ferrotungsten and low-carbon ferrochromium. It is now installing additional equipment for increasing materially its output of these and other ferroalloys. The works and business of the Willson Aluminum Company have been sold and transferred to the Electro-Metallurgical Company, which is adding also to the plant at Kanawha Falls, W. Va., with the object of increasing materially the capacity there, particularly in ferrochromium and ferrosilicon. The company has an Eastern office at 79 Wall Street, New York.

GENERATING UNITS.—The advantages of a generating set in which both engine and generator are designed one for the other and manufactured by the same company are evidenced in recent orders received by the B. F. Sturtevant Company, of Boston, Mass., as follows: three sets for the American Dredging Company, Philadelphia, Pa.; two sets for Newport News S. & D. D. Company, Newport News, Va.; two sets for the Hudson Companies, New York City; Pittsfield Street Railway Company, Pittsfield, Mass.; Louis M. MacDermott, Oakland, Cal., and Industrial Works, Bay City, Mich.

ALLIS-CHALMERS ORDERS.—The Quaker Oats Company, Cedar Rapids, Ia., has lately purchased a 425 kw and a 75 kw Allis-Chalmers polyphase generator, with exciter, for carrying the motor and lighting load of the Cedar Rapids Quaker Oats factory. The Norfolk and Western Railway will install a 175 kw and a 150 kw Allis-Chalmers alternator, one belted and the other engine type, with exciters for carrying the motor and lighting load of the railway shops at Bluefields, W. Va.

THE DENVER ELECTRIC COMPANY has been organized at Mobile, Ala., with $5,000 capital, and will be glad to receive catalogues of all electrical appliances and supplies. Mr. D. B. Gillespie is among those interested.

AS TO COPPER.—The National Conduit and Cable Company in its latest "Copper Gossip" speaks of copper conditions as follows: "The most important recent business was the sale of some millions of pounds of copper by the Calumet & Hecla Company at the tip-top prices of 26½ for April and 26 for May and June deliveries. It was something of a surprise to the trade that the sellers of this particular brand should decide to put two different prices on the copper disposed of in the business alluded to, and the fact was regarded as a determination of the parties of the first part to lead manufacturers to properly appreciate the luxury of a fancy article. Since these transactions the entire market has hardened, and other brands have advanced from ¼ to ½ cent per pound. Conditions in the copper and brass manufacturing industries are good, but the operations of these interests could be carried on in a more satisfactory manner, in some cases at least, if it were always possible to obtain plenty of raw material for the three months immediately ahead. Consumers are not particularly concerned about the price of copper, but that which chiefly interferes with the conduct of their business along normal lines is the inability to get copper in sufficient quantity for delivery within 60 to 90 days, so that the entire machinery of their establishments may be kept continuously going at full capacity. To secure full supplies it is necessary to contract for them four or five months in advance, and in our judgment this course becomes too great a speculative proposition, with values at the present level, to harmonize with the principles of a sound, conservative business policy. Whether copper costs the manufacturer 25 or 30 cents a pound is a question of secondary consideration. The essential thing for the consumer is the ability to secure metal in the quantities wanted and at the time wanted. There exists a good demand for copper at present, and when this is the case it can be turned into a manufactured state, delivered and paid for in a reasonable time. But to assume obligations and enter orders of an enormous aggregate, and then have to wait from four to six months before a fulfillment of these can be accomplished, this is an ordeal of too exacting a nature for legitimate manufacturers to assume without placing a heavy premium upon their capacity for business acumen. The strain upon credit inseparately connected with the process is in danger of becoming too intense for the preservation of a healthy tone in the situation."

WESTINGHOUSE LAMP COMPANY.—A change of company name of more than usual interest to the trade took place April 1, 1907. On and after that date, the Sawyer-Man Electric Company is to be known as the Westinghouse Lamp Company. Thus the name of a pioneer company in the lighting industry becomes a matter of history. It has, of course, been generally understood for some years past, that the Sawyer-Man Electric Company was a Westinghouse interest, and the change of name is but a logical result of changed conditions. But the legal and industrial warfare waged around the Sawyer-Man patents is electrical history that can never be forgotten.

CONTRACT FOR PLANT.—The R. E. Moore Company of Wilmington, Del., has just received a contract for the installation of a power and lighting plant in one of the Southern States. The installation consists of one 425-kw alternating current, 440 volts, 3-phase generator; one 20-kw direct current, 240 volt generator and one 50-kw 220 volt direct current generator; one 150 3-phase inductive motor; 5-30 hp, 3-phase induction motors; 3-20 hp 3-phase induction motors; one 10 hp 3-phase induction motor; one 75 hp 3-phase induction motor; 2-40 hp 3-phase induction motors; one 5 hp 3-phase induction motor; 50 direct current 220 volt arc lamps and 500 incandescent lamps. The company has recently moved to No. 507 Tatnall Street.

ALLIS-CHALMERS GENERATORS. — The Western Maryland Railroad Company has recently built new shops at Hagerstown, Md., to be used for the general repair of locomotives and equipment used on the division. These new shops, which will employ approximately 100 men, have a floor space of 70 ft. x 300 ft. The electrical equipment, which will furnish power for the shop drive will also be used to light the company's terminal properties and operate the transfer table at the roundhouse. This equipment comprises a 150-kw and a 250-kw Allis-Chalmers direct-current generator, with exciter units of 10 kw and 15 kw capacity respectively, and a small motor generator set.

CATALOGUES WANTED.—The Dixie Electric and Machine Company, of Columbia, S. C., is in the market for electrical supplies for light, power, etc., and will be glad to receive catalogues of everything electrical. Mr. E. A. Sweet is the president and general manager and Mr. H. L. Edwards is the secretary and treasurer.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was dull but showed a firmer undertone, the Easter holidays abroad and the close of the local Stock Exchange on Saturday discouraging any disposition toward activity. Extensive liquidation has apparently ceased, but despite the somewhat better money market conditions and the allegations that powerful interests have again come to the support of prices, covering of shorts seemed mainly responsible for the moderate rallies which took place. More or less stress was laid upon the attitude of the national administration toward railroads. The various 2-cent fare bills, as well as the public utilities measure under discussion at Albany, were also considered unfavorable, while, although denials are put forth that a wholesale curtailment of railroad improvement work is intended, it is urged that a movement of that kind may be sufficient to produce an adverse impression on other lines of business. The threatened strike of western railroad employees was another matter which received consideration. The market, on the other hand, had also some favorable elements to cheer it. The most prominent of these was the announcement that Secretary Cortelyou would deposit $14,000,000 of customs receipts in New York depository banks, and would, furthermore, facilitate the redemption of the 4 per cent bonds, these steps having a good effect upon the money market. Bank clearings for the week ending March 28 aggregate $3,063,262,000, 20 per cent under the previous week, but 18.6 per cent above the corresponding week last year. Outside of New York, exchange amounts to $1,089,800,000, 8 per cent below week before last, but 16 per cent over the corresponding week last year. Electric and traction securities were stronger and more active, and many substantial gains were recorded at the close of the week. There was some weakness in spots, however, with declines, but these were comparatively few, and evidently had no connection with the sentiment of the market in general, which was of a firmer character. The curb market followed the lead of the main market, and there was a general pressure to liquidate early in the week. After that there was a gradual recovery which was continued off and on until the close of the week. Following are the closing quotations of April 2:

NEW YORK.

	March 26	April 2		March 26	April 2
Allis-Chalmers Co.....	11½	11	General Electric.....	141	145
Allis-Chalmers Co. pfd.	27	27½	Hudson River Tel.....	..	..
American Dist. Tel....	..	..	Interborough Met. com.	23¾	25
American Locomotive..	60	62⅞	Interborough Met. pfd.	54	61
Amer. Locomotive pfd.	102	105	Mackay Cos.....	66	..
American Tel. & Cable.	75	75	Mackay Cos. pfd.....	65½	..
American Tel. & Tel..	..	..	Marconi Tel.....	..	..
Brooklyn Rapid Transit	49½	58¾	Metropolitan St. Ry...	..	..
Electric Boat.....	32	32	N. Y. & N. J. Tel.....	..	..
Electric Boat pfd.....	80	80	Western Union Tel....	80	81½
Electric Vehicle.....	..	..	Westinghouse com.....	148	147
Electric Vehicle pfd...	..	..	Westinghouse pfd.....	..	..

BOSTON.

	March 26	April 2		March 26	April 2
American Tel. & Tel...	117	119¾	Mass. Elec. Ry. pfd...	57	60¾
Cumberland Telephone.	..	..	Mexican Telephone....	..	..
Edison Elec. Illum....	212	208	New England Telep...	114½	117
General Electric.....	142	147	Western Tel. & Tel...	..	6
Mass. Elec. Ry.....	15⅞	17	West. Tel. & Tel. pfd..	..	..

PHILADELPHIA.

	March 26	April 2		March 26	April 2
American Railways....	49	48½	Phila. Electric.....	7½	8½
Elec. Co. of America..	9⅛	9⅝	Phila. Rapid Trans....	15¾	16¼
Elec. Storage Battery..	51½	52	Phila. Traction.....	91	92
Elec. Storage Bat. pfd.	..	..			

CHICAGO.

	March 26	April 2		March 26	April 2
Chicago City Ry.....	150	..	National Carbon.....	70	..
Chicago Edison.....	..	..	National Carbon pfd..	*110	..
Chicago Subway.....	..	..	Union Traction.....	..	..
Chicago Tel. Co.....	..	..	Union Traction pfd....	..	..
Metropolitan Elec. com.	23	..			

*Asked.

BELL TELEPHONE BONDS.—Ever since the public offering of the American Telephone and Telegraph 4 per cent convertible bonds in February, says the *Wall Street Journal*, there has been more or less doubt as to the actual amount of these bonds disposed of at that time. Payments to the underwriters by the syndicate managers on

Thursday, however, took up one-tenth of the entire amount of the bonds allotted to them, which means that the amount of bonds disposed of at the sale was probably slightly in excess of $10,000,000. It is not believed that any action will be taken on the protest filed at the annual meeting last week by one of the largest stockholders against the reduction of the option price of these bonds to the syndicate, and the method of financing the company's needs by the issue of $25,000,000 short term notes.

DIVIDENDS.—Directors of the Forest City Railway Company (Cleveland) have declared the regular quarterly dividend of 1½ per cent, payable April 1. Directors of the Bangor (Me.) Railway & Electric Company have declared the regular quarterly dividend of 1¼ per cent, payable April 1. Directors of the Westinghouse Air Brake Company have decided the regular quarterly dividend of 2½ per cent and the usual extra dividend of 2½ per cent, payable April 10. Directors of the Westinghouse Machine Company have declared the regular quarterly dividend of 2½ per cent, payable April 10. Directors of the Cuyahoga Telephone Company have declared the regular quarterly dividend of 1 per cent on the common stock and 1½ per cent on the preferred. Directors of the Chicago Pneumatic Tool Company have declared the regular quarterly dividend of 1 per cent, payable April 25. Directors of the Central & South American Telegraph Company have declared the regular quarterly dividend of 1½ per cent, payable April 9. Directors of the Mexican Telegraph Company have declared the regular quarterly dividend of 2½ per cent, payable April 16. The directors of Manning, Maxwell & Moore have declared the regular quarterly dividend of 1½ per cent, payable April 1. Directors of the Nernst Lamp Company have declared a quarterly dividend of 2½ per cent. Directors of the Manchester Traction, Light & Power Company of Manchester, N. H., have declared a regular quarterly dividend of 1½ per cent, payable April 15. The directors of the Multiphone Operating Company have declared the regular monthly dividend of 1 per cent, payable April 1. Directors of the Cincinnati, Newport & Covington Light & Traction Company have declared the regular quarterly dividend of 1⅛ per cent on the preferred stock, payable April 15. Directors of the R. D. Nuttall Company have declared a dividend of 6 per cent, making 20 per cent for the year. The company is a subsidiary of the Westinghouse Electric & Manufacturing Company.

ELECTRIC STORAGE BATTERY REPORT.—The Electric Storage Battery Company has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906.	1905.	1904.	1903.
Gross	$1,331,799	$1,467,486	$1,344,536	$1,761,058
Expenses	401,092	389,032	378,877	352,048
Net	$930,707	$1,078,454	$965,659	$1,409,010
Other income	128,665	135,533	117,249	92,581
Total income	$1,059,372	$1,213,987	$1,082,908	$1,501,591
Dividends	812,450	812,440	812,435	812,435
Surplus	$246,922	$401,547	$270,473	$689,156
Previous surplus	$3,556,994	$3,198,864	$2,972,633	$2,323,354
Total surplus	$3,803,916	$3,600,411	$3,243,106	$3,012,510
Adjustment	49,465	43,416	44,243	39,877
P. & L. surplus	$3,754,451	$3,556,995	$3,198,863	$2,972,633

After allowing for 5 per cent on the outstanding preferred stock the balance of surplus shows 5.7 per cent earned on the $17,785,800 common stock. The statement of current assets and liabilities is as follows:

Current Assets.

Cash on hand and in bank	$184,424
Accounts receivable	1,220,137
Notes receivable	342,111
Inventory accounts, raw materials, stock in process, finished products, and unexpired insurance	1,262,828
Total current assets	$3,009,500

Current Liabilities.

Accounts payable, not yet due	$149,268	
Sundry liabilities	16,813	
		166,081
Net surplus of current assets over liabilities		$2,843,419

VEHICLE EQUIPMENT COMPANY.—The Vehicle Equipment Company has made a composition to its creditors in satisfaction of claims owed by it to each of said creditors. It appears that the greater portion of the assets of the estate has been realized upon, so that the total values of all assets in the hands of the trustees can be computed at $182,723.52. After deducting the expenses of the bankruptcy proceedings, there is left for distribution $172,367.08. Of the latter amount, the claims of the bondholders, who, under the terms of the order of sale, are entitled to the same lien upon the proceeds as they had upon the property, will take $77,133.08, which will be a dividend upon the $861,000 of the bonds of 8.958 per cent, leaving a deficiency on these claims of $783,866.92. After distributing $77,133.08 among the bondholders, there is left of the assets of the estate $95,234; and taking out the claims of preferred wage earners and taxes due, there is left available for distribution among the general unsecured creditors and towards the payment of the deficiency on the bonds, the sum of $93,593.66. The total amount of claims, counting in the bond deficiency, entitled to participate in the division of this fund, is $1,214,624.41; and the percentage of dividends out of the fund applicable for the payment of this amount is 7.71 per cent.

ECCENTRICITIES OF TAXATION.—Vice-president Williams, of the Brooklyn Rapid Transit Company, appeared before the State Tax Commission recently to protest against its tax assessments. He stated that the company's assessments are $50,000,000 at least too high and that the assessments on its properties exceed by $130,000,000 the normal market value of its securities. The total assessment is $59,436,000, an increase of $20,905,000, or 54.26 per cent over the final assessment of last year. At last year's tax rate this represents a tax of $2,512,744. Other forms of taxation for the year will amount to $1,119,612, making a total of $3,632,356. This represents property value amounting to $236,000,000 on the basis of last year's tax rate. This is $97,000,000 more than the par value of the company's outstanding stocks and bonds and $130,000,000 more than the market value of Jan. 1 of its outstanding stocks and bonds. The assessment has been increased 54.26 per cent, while that of the Interborough is increased only 33⅓ per cent, the Manhattan Elevated Railroad Company 23 per cent, and the New York City Railway Company 33½ per cent.

CANADIAN GENERAL ELECTRIC.—The Canadian General Electric Company has preferred stock of $300,000 and common stock of $4,700,000. Its plant, machinery, patents, etc., are carried at $4,846,319. The profit and loss account for the year ended December 31, 1906, is as follows:

	1906.	1905.	1904.	1903.
Profit on operation	$1,073,675	$608,207	$582,519	$512,211
Interest amount written off, etc.	290,713	263,859	221,486	142,885
Balance	$782,962	$344,348	$361,033	$369,326
Reserve fund	320,000	.....	75,000	100,000
Balance	$462,962	$344,348	$286,033	$269,326
Dividends	484,690	335,499	284,890	269,277
Deficit	$21,728	$8,849	$1,143	$49
Previous surplus	90,763	81,913	80,769	80,722
Profit and loss—surplus	$69,035	$90,762	$81,912	$80,771

Profits on operations include $220,000 received from premium on new stock, and reserve fund includes $220,000 transferred to reserve fund for premium on new stock.

BUFFALO BELL TELEPHONE.—The annual report of the Bell Telephone Company of Buffalo has been issued, as follows:

	1906.	1905.	1904.
Gross earnings	$1,573,547	$1,400,264	$1,239,212
Expenses including material	1,001,924	845,145	783,671
Net earnings	$571,623	$555,119	$455,541
Dividends	435,600	363,000	327,918
Balance	$136,023	$192,119	$127,623
Charge to department	136,023	192,119	127,623
Surplus	.....	.....	.....
No. of stations	52,870	45,563	36,611

Dividends at the present rate of 6 per cent per annum have been paid uninterruptedly for over 25 years.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company reports $478,854 gross earnings for February and $145,803 after all charges. The gross for two months is $965,571 and the surplus $288,576, or about $9,000 more than last year.

CANADIAN BELL TELEPHONE COMPANY.—The Bell Telephone Company of Canada will issue $2,500,000 of stock, increasing its capital from $10,000,000 to $12,500,000. The new stock will be issued at $100 a share, as compared with $125 at the last issue.

KEYSTONE TELEPHONE COMPANY, of Philadelphia, shows $82,687 gross earnings for February, and $41,519 net. The eight months gross is $647,085 and the net $298,080, an increase of $55,375.

CANADIAN WESTINGHOUSE REPORT.—The Canadian Westinghouse Company has issued its annual report for the year ended Dec. 31, 1906. The income account is subjoined:

	1906.	1905.		
Net earnings	$346,961	$220,545	Inc.	$126,416
Depreciation and adj	120,000	.....	Inc.	120,000
Balance	$226,961	$220,545	Inc.	$6,416
Dividends	179,550	149,100	Inc.	30,450
Surplus	$47,411	$71,445	Dec.	$24,034
Previous surplus	232,041	160,596	Inc.	71,445
P. & L. surplus	$279,452	$232,041	Inc.	$47,411

After charging off $120,000 for depreciation, adjustments, surplus for dividends shows 6.48 per cent earned on the $3,489,000 capital stock. The president, Mr. George Westinghouse, says that the plant and equipment of the company have only recently been completed at costs less than present values; nevertheless, the directors have considered it a conservative measure to create a reserve fund for future depreciation and also a reserve for possible reduction of values of materials and products on hand at the close of the year, although the amount of these items as shown on the statement correctly represents their actual costs according to a careful inventory. During the year the capital stock of the company was increased from two and one-half millions to five million dollars, and one million dollars of this increase was sold at par to the shareholders. The gross shipments during the year increased approximately 40 per cent, compared with the previous year and about 100 per cent compared with the year ended Dec. 31, 1904. Continued prosperity and business activity still prevail throughout the Dominion and the prospects for the coming year are favorable for a further extension of the business of the company. Unfilled orders on Jan. 1, 1907, aggregated $1,637,658.

THE LOS ANGELES EDISON.—The Edison Electric Company, of Los Angeles, has plans for the development of additional power in Southern California. Its Kern River plant is nearing completion, and when it is in operation with its 116-mile transmission to Los Angeles, the company will have available, approximately, 55,000 horse-power. Even this large amount will not be sufficient, because of the increased volume of business. At a recent meeting of the stockholders of the company it was decided to add $1,200,000 to the capital, making the entire capitalization $11,200. This increase is necessary because of the volume of work which is being undertaken. The Kern River plant has been enlarged, the water power capacity of the system increased 200 per cent, and the steam power 125 per cent. Manager A. L. Selig states that the prospects for a steady improvement in business are very bright. The earnings of the company last year increased about $460,000, while the expenses increased $200,000. The electric lighting business has increased 27 per cent, the power business 45 per cent, and the fuel business 49 per cent. The company proposes to place on the market 12,000 shares of common stock at $75 a share. It is the intention of the board of directors to make the first payment of dividends on the capital stock on Aug. 15, 1907. This will amount to about $1.25 per share. The preferred stock of the company amounts to $4,000,000. In addition to the present plant on the Kern River, the Edison Electric Company owns five other water power sites on the same stream which can be developed to give upward of 150,000 horse-power when occasion demands.

STONE & WEBSTER REPORTS.—Stone & Webster report the earnings of the following companies for the month of January, 1907, as follows:

CAPE BRETON ELECTRIC CO., LIM.				
January gross	$19,734	$19,899	Dec.	$165
Net	5,891	7,377	Dec.	1,486
January surplus over charges	1,641	2,982	Dec.	1,341
EL PASO ELECTRIC CO.				
January gross	$37,042	$27,346	Inc.	$9,696
Net	8,341	7,593	Inc.	748
January surplus over charges	3,872	3,844	Inc.	28
GALVESTON ELECTRIC CO.				
January gross	$25,547	$19,349	Inc.	$6,198
Net	9,007	5,382	Inc.	3,625
January surplus over charges	4,840	1,215	Inc.	3,625
HOUGHTON COUNTY ELECTRIC CO.				
January gross	$27,852	$25,360	Inc.	$2,492
Net	16,248	15,356	Inc.	892
January surplus over charges	13,435	12,543	Inc.	892
HOUSTON ELECTRIC CO.				
January gross	$50,093	$43,076	Inc.	$7,017
Net	16,865	12,939	Inc.	3,926
January surplus over charges	6,533	2,392	Inc.	4,141
JACKSONVILLE ELECTRIC CO.				
January gross	$31,727	$24,913	Inc.	$6,814
Net	10,285	10,376	Dec.	91
January surplus over charges	6,810	7,051	Dec.	241
LOWELL ELECTRIC LIGHT CORPORATION.				
January gross	$28,747	$25,959	Inc.	$2,788
Net	11,653	10,269	Inc.	1,384
January surplus over charges	9,892	8,908	Inc.	984
MINNEAPOLIS GENERAL ELECTRIC CO.				
January gross	$84,266	$73,841	Inc.	$10,425
Net	41,799	40,857	Inc.	942
January surplus over charges	32,911	31,807	Inc.	1,104
WHATCOM COUNTY RAILWAY & LIGHT CO.				
January gross	$28,063	$23,971	Inc.	$5,092
Net	13,088	7,330	Inc.	5,758
January surplus over charges	6,874	3,426	Inc.	3,448

FRAUDULENT TELEPHONE MORTGAGE.—Advices from Milwaukee, Wis., state that a $15,000 mortgage on all the property of the Standard Telephone and Electric Company, bankrupt, has been declared by Referee Maxwell to be fraudulent and void as concerns the general creditors of that company. The petition of the owner of the mortgage that the sale of the assets of the company be made subject to the mortgage has been denied and the property will be sold by the trustee in bankruptcy free and clear of incumbrances. Shortly following the filing of a petition in bankruptcy against the local company, and the election of a trustee, a petition for permission to sell the assets of the concern was made to the court by that official. This was followed by another petition filed by K. K Knapp, of Chicago, holder of the mortgage, in which the court was asked to hold the mortgage as being a first lien on the property and that the proposed sale be made subject to the satisfaction of the mortgage. Testimony of numerous witnesses relative to the legality of the mortgage was taken before the referee, as a result of which the decision was handed down declaring the mortgage fraudulent and void. It is said that an appeal will be taken from the decision of Judge Quarles. T. H. Hill is president of the bankrupt company, E. A. Wadhams is vice-president, and H. M. Eldred is secretary.

WESTERN UNION REPORT.—The Western Union Telegraph Company has issued its preliminary estimated statement for the quarter ending March 31, 1907, as compared with actual figures for the same period of 1906 and 1905, as follows:

	1907.	1906.	1905.
Net revenue	$1,600,000	$1,469,159	$1,546,087
Bond interest	384,687	331,300	300,800
Balance	$1,215,313	$1,137,859	$1,245,287
Dividends	1,217,024	1,217,023	1,217,021
Deficit	$1,711	$79,164	*$28,266
Previous surplus	17,026,616	16,738,356	15,793,258
Total surplus	$17,024,905	$16,659,192	$15,821,524

*Surplus.

The actual figures for the quarter ending Dec. 31, 1906, are as follows: Net revenue, $1,616,971; interest on bonded debt, $332,687; dividends, $1,217,024; previous surplus, Oct. 1, 1906, $16,959,535; total surplus, Dec. 31, 1906, $17,026,616.

TELEPHONY AT COLUMBUS, O.—A special meeting of the stockholders of the Columbus Citizens' Telephone Company will be held at the offices at 2 o'clock p. m. on April 24 for the purpose of voting on the proposition to increase the number of directors from 9 to 11, and amend the by-laws in such a manner as to allow this change; also to decide upon the proposed increase of capital stock from $1,250,000 to $1,750,000. The additional capital stock will be in 6 per cent preferred, the same as the $500,000 preferred now outstanding. This stock is now worth about $112. Should the stockholders be offered the new stock in proportion to their present holdings, each will have a right to subscribe for about 20 per cent of what he now holds. Additional money is necessary to bring the plant up to the capacity needed. The increase in the number of subscribers in the past sixteen months has been 45.72 per cent, or from 6900 to 10,068 up to March 1. The gross income has increased 42 per cent. Only half of the additional stock will be issued now and the remainder will be held for future needs.

DEMAND FOR ALUMINUM.—It is said that production of aluminum in this country has reached 25,000,000 lbs. a year. The foreign manufacturers are, like the domestic producers, pressed by demand in far greater proportion than it is possible to supply. The British Aluminum Company has decided to increase its capital stock from £700,000 to £1,300,000 for the purpose of providing funds to pay for contemplated increased capacity in Switzerland, Norway and Loch Leven.

TOLEDO EARNINGS.—The Toledo (O.) Railways & Light Company reports for January, gross earnings of $170,684, as compared with $159,053 in 1906. The surplus for the month was $27,459, as compared with $33,615 after charges.

TROUBLES AT XENIA, OHIO.—A receivership for the People's Gas & Electric Light Company, of Xenia, Ohio, an Ohio corporation, capitalized at $175,000, and controlled by the Western Gas & Investment Company, a South Dakota concern, with offices in Chicago, has been asked in the United States Circuit court at Cincinnati, O., by Evelyn Bird, of Chicago, a holder of bonds of the Xenia company. It is charged that the company has been mismanaged, money being diverted from its proper channels to pay high salaries of the holding company in Chicago, and that through failure to pay taxes and to keep the property in proper condition, there is danger of the plant being sold for taxes, and of the loss of franchise rights. A temporary injunction was issued against the Xenia Sheriff, the Western Gas & Investment Company and others, forbidding any dispotion of the plant or its earnings pending the receivership suit. One of the charges in the suit is that the Western Gas & Investment Company has secured control of gas or electric companies at a large number of places, overbonded them, taken the receipts, and wherever possible, evaded paying debts. Among the companies brought under the control of the Western Gas & Investment Company are the Madison Lighting Company, of Madison, Ind.; the Seymour Gas & Electric Light Company, of Seymour, Ind.; the Rochester Gas Company, of Rochester, Minn.; the Baraboo Lighting Company, of Baraboo, Wis.; the Citizens' Gas Company, of Nebraska City, Neb., and others. It is alleged that the holding company retained all stock in these companies except a few shares needed for purposes of naming directors in the various States, and that in each of these cases the holding company issued bonds far in excess of the actual value of such companies. The Western Gas & Investment Company, it is further alleged, "adopted a system whereby the cash receipts of each of the operating companies were forwarded daily to it at its offices in the city of Chicago, State of Illinois, and permitted only such bills to be paid and debts of the operating companies to be satisfied as circumstances rendered absolutely necessary; that in consequence of said fraudulent and unlawful methods, the said operating companies have been permitted to become out of repair, insolvent and to default their taxes, by reason of which the property of said companies has in some instances been sold for taxes and in other instances is in process of sale."

SIMPLEX TELEPHONE EQUIPMENT.—The officers and directors of the Simplex Telephone Equipment Company, of Rochester, N. Y., have been enjoined by Mr. J. A. Nolan, a stockholder and its manager, from disposing of its assets and dismissing him. The Simplex Company was incorporated on July 18, 1906. Its officers are Louis E. Kirstein, president; Alfred Michaels, vice-president; John A. Nolan, secretary; Rudolph Stein, treasurer. These officers, with John A. Roberston, Samuel Weill and Garrison Babcock, constitute the board of directors. The company has a capital stock of $300,000. Its factory is at 430 Main Street East. Nolan alleges that he was employed as manager and was receiving $150 a month. On March 2 the directors voted to suspend business temporarily and appointed a committee to investigate its condition. A report was made as to the assets, but not as to the liabilities. A committee was then appointed to liquidate the company, over the votes of Nolan and Babcock. Nolan claims that all employees with the exception of the superintendent were discharged. The company had a demand note with the Merchants Bank for $2,100 and a motion was carried by the directors that the company should confess to judgment. Babcock, who is the patentee of some of the devices manufactured, asked a 30 days' option for purchase of the company at $10,000 and the assuming of all liabilities. This offer was refused. Now Nolan claims that the directors are attempting to sell the company's assets with the intention of allowing certain directors to acquire them and form a new corporation, depriving him of his share in the company and his position as manager. He is a stockholder to the amount of $19,000. He claims the company is in good condition.

BELL TELEPHONE FINANCING.—At the annual meeting of the American Telephone & Telegraph Company, Attorney Sturgis, representing J. S. Fay, Jr., the fifth largest stockholder, protested against the financing by the management as shown in the last two annual reports. Mr. Sturgis stated that ever since 1881 Mr. Fay has been a stockholder of the company, he has never sold any of the stock and had always backed the actions of the management until the issue of the convertible bonds. In the report of March 27, 1906, it was said that the directors had sold $100,000,000 convertible bonds of the $150,000,000 authorized on terms favorable to the company; and that this amount would be sufficient to supply funds to the company until 1908, and would include the retirements of $20,000,000 notes due May 1, 1907. According to the last report dated January, 1907, the company has sold $25,000,000 three-year 5 per cent notes at a reasonable price to pay off their floating debt. The directors sold this $25,000,000 notes to the same bankers, viz., J. P. Morgan & Co., at a reduced price and reduced the option price of the remaining $50,000,000 convertible bonds to a figure far below that at which they were offered to the public. This action Mr. Fay deems unfavorable to the best interests of the company. He stated that it showed poor financial judgment. President Fish then stated that the directors had acted to conserve the interests of the stockholders to the best of their ability. The Sturgis resolution was overwhelmingly voted down.

BRILL CAR CONSOLIDATION.—The J. G. Brill Company of Philadelphia, one of the largest of the street car manufacturing concerns in the world, has completed the financing of its purchase of the Wasson Manufacturing Company, of Springfield, Mass., which, as announced some days ago, is to be taken over by the Brill Company on April 1. By the sale through Edward B. Smith & Company, of Philadelphia, of $1,270,000 of preferred stock at par the Brill Company has been provided with funds to take over the Wasson Company and also with additional working capital. The newly issued stock of the J. G. Brill Company, according to present plans, is to be listed on the Philadelphia Stock Exchange. The earnings of the company, it is officially stated, are sufficient to meet the dividend on the preferred stock and leave a surplus equivalent to about 10 per cent on the common stock. The Brill Company is manufacturing at present about 3500 cars a year, and employs about 4000 men.

NEW YORK FRANCHISES.—Franchise tax assessments for 1907 for New York are reported by the State Board of Tax Commissioners, which consists of Egbert E. Woodbury, Frank E. Perley, and Benjamin E. Hall. New York City corporations are increased from $361,479,300 to $466,855,000, an increase of $105,375,700. Some of the assessments upon widely known New York City corporations are as follows: Brooklyn Rapid Transit System, $54,645,000, an increase of $16,166,000 over 1906; Manhattan Elevated System, $74,900,000, an increase of $12,200,000; Metropolitan Street Railroad System, $103,500,000, an increase of $24,130,000; Consolidated Gas System, $100,500,000, an increase of $17,579000; Brooklyn Union Gas System, $19,120,000, an increase of $2,170,000; New York Telephone Company, $27,400,000, an increase of $10,312,000.

NIAGARA POWER BONDS.—The New York State Commission of Gas and Electricity will give a hearing April 16 to the Niagara Falls Power Company on an application for consent to an issue of $1,500,000 bonds, as of Dec. 31 last, to be issued against debentures of the Canadian Niagara Falls Power Company, the proceeds being intended for the completion and extension of the works of the Canadian company. Consent is also asked by the Niagara Falls Company for the issuance of the same series from time to time up to $5,000,000. The Niagara Falls Company also filed a petition for consent, as of June 30 last, to the purchase of certain shares of the capital stock of the Tonawanda Power Company and to its acquisition of the remainder of outstanding shares of that company.

NEW JERSEY TELEPHONE.—The stock of the New York & New Jersey Telephone Company has been put on a 7 per cent basis by the declaration of a quarterly dividend last week of 1¾ per cent. While the company has been paying 7 per cent heretofore, the dividends have taken the form of a 1½ per cent quarterly and an extra dividend of 1 per cent at the close of the year. The dividend just declared is payable April 15.

GENERAL ELECTRIC BUSINESS was never better, and never so good. The orders received by the company for the first six weeks of the new fiscal year beginning Feb. 1 have shown an increase over the corresponding period of 1906 of between 30 and 35 per cent. Orders received during this period were at the rate of $78,000,000 for the year. The gross business for the year just ended was a little more than $58,000,000.

SALE OF BONDS.—The city of Covington, on April 15 will sell $20,000 five per cent thirty year bonds, of which $15,000 is for paying off the debt incurred in rebuilding the electric light plant. The original lighting bonds were for $15,000 payable in 1921. Mr. George T. Smith is city clerk and treasurer.

GENERAL NEWS.

Construction News.

ARGENTA, ARK.—The City Council has passed the ordinance authorizing the purchase of the new electric light and power plant and system of the Argenta Light & Power Company by the city for the sum of $50,000.

BENTON, ARK.—The City Council has refused to renew the street lighting contract with the Benton Light, Power & Ice Company, of Benton, and as a consequence the city streets are in darkness.

ENGLAND, ARK.—The City Council has leased to Thos. B. Marten, Jr., of Little Rock, its water works and electric light plant for a term of six years. Joseph T. Lewis is city recorder.

LITTLE ROCK, ARK.—At a mass meeting of the business interests of Little Rock held recently to discuss plans for raising funds to help finance the Little Rock and Hot Springs Electric Railway, $31,300 was raised. The Allis-Chalmers Company and the Electrical Installation Company, of Chicago, Ill., propose to provide $1,200,000 of the amount necessary to build and put the road into operation. Little Rock, Hot Springs and intervening territory is asked to contribute $400,000 by purchasing $500,000 worth of 6 per cent preferred stock.

LITTLE ROCK, ARK.—The Little Rock Railway & Electric Company has purchased from the General Electric Company a 1500-kw turbine. The company is rebuilding and repairing six miles of track and rebuilding its car house, in which an elevator and new machinery are being installed.

OZARK, ARK.—The City Council has granted an electric light franchise to the Altus Gin & Manufacturing Company.

FOLSOM, CAL.—Wm. Muir, of Sacramento, has commenced work on the construction of a dam below Colfax Bridge, on the north fork of the American River. Mr. Muir and his associates are going to put in a large electric plant this summer at the junction of the north and the middle forks of the American River.

KELSEYVILLE, CAL.—An ordinance has been passed by the Board of Supervisors granting to Lake County Electric Power Company the franchise and privilege of erecting poles and wires for the purpose of transmitting and distributing electricity for light, heat and power purposes on certain streets in Lake County, Cal.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Works until May 20 (extension of date from May 6), for furnishing and erecting near Tehachapi, Kern County, for the city of Los Angeles the necessary boilers, engines, electric generators and motors for delivering 1250-hp electric current to the Los Angeles Cement Works, all equipment to be erected by bidders with exception of electric motors. Horace B. Ferris is secretary.

RED BLUFF, CAL.—Allen Waller has filed notices of appropriation of 10,000 miners' inches of water in Mill Creek, between Jones Valley and Onion Creek; also for a site for a dam 50 feet high and a mill site. It is understood that the Pacific Power Company is interested in the project.

SAN BERNARDINO, CAL.—The San Bernardino Valley Traction Company has issued $1,000,000 in bonds for the purpose of making extensions.

WILLOWS, CAL.—The Northern California Power Company has closed a contract with the Central Canal Company to furnish power for pumping water into the canal. The company will immediately install a 600-hp sub-station at the mouth of the canal and the pumping plant will be equipped with two 225-hp motors. Next year the plant will be increased and the company will use 1800 horse-power The pumps at the headgate are now being installed and will be in readiness by May 1.

MIDDLETOWN, CONN.—The Consolidated Railway Company is contemplating the immediate construction of a sub-station in the north end of Middletown to reduce the high voltage received from the power station at Berlin, to use on the branch road when that system is electrified, which will be done in the near future. After the present contract expires with the Middletown Electric Light Company, electricity from the sub-station will be utilized for operating the electric railway system in the city.

NEW BRITAIN, CONN.—The Traut & Hine Manufacturing Company will install a new power plant in connection with its new factory buildings. An addition will be made to the present building and new engines of 350 horse-power will be installed. The capacity of the present plant is 175 horse-power.

JACKSONVILLE, FLA.—A special election will be held April 16 for the purpose of voting on the ordinance recently passed by the City Council granting the Jacksonville Electric Company certain privileges and franchises.

PELHAM, GA.—The citizens, at an election held recently, voted to issue bonds for water works, electric lights, sewers and an ice plant.

ROME, GA.—The City Council has passed a resolution ordering an election to be held April 16, to vote on the proposition of issuing $175,000 in bonds for the purpose of erecting an electric lighting plant. In case the bond issue fails the Council will probably levy a special tax and build a lighting plant.

McLEAN, IDAHO.—Thomas Campbell, manager of the Pembina Portland Cement Company, is planning to build a railway from the inland village of McLean to a Great Northern line. It is estimated that the new line will cost about $200,000.

LOCKPORT, ILL.—It is reported that bids will soon be asked for by the Drainage Board of Chicago, for the installation of electrical apparatus in the Lockport power house.

RUTLAND, ILL.—The capital stock of the Central Illinois Independent Telephone Company has been increased from $30,000 to $75,000.

COVINGTON, IND.—A mortgage for $1,250,000 has been filed by William G. Ruhl, president of the Covington & Southwestern Electric Railway Company in favor of the Trust Company of America, of New York, N. Y., and the Union Trust Company, of Indianapolis.

GREENFIELD, IND.—The Hanna-Jackson Telephone Company's plant in this city has been sold by the receiver to Charles H. Hanna. A new company will be organized to rebuild and re-equip the plant and greatly improve the service.

INDIANAPOLIS, IND.—Ohio and Indiana capitalists are said to have organized a company with $6,000,000 to build an electric railway from Toledo to St. Louis. C. D. Whitney is president; George Metzger, vice-president; J. P. McAfee, treasurer; S. L. McAfee, secretary, and Riggs & Sherman, engineers. Mr. Whitney states that the road has been financed and much of the preliminary work incident to the beginning of construction has been completed. He also states that the new company has taken over the electric power plant at Lima, Ohio, to furnish power for the first section.

LAPORTE, IND.—The Murdock syndicate, which recently acquired extensive electric properties in northern Indiana, has announced that it will soon begin the construction of a line from this city to Logansport, a distance of 60 miles.

NEW ALBANY, IND.—The United Gas & Electric Company is contemplating changing the street lighting system of its plant.

RICHMOND, IND.—The Indiana & Ohio Traction Company has made application to the County Commissioners of Wayne County for a franchise for an electric railway between Richmond and Hamilton, Ohio.

DECORAH, IA.—The concrete dam and power house just completed by the Upper Iowa Power Company, seven miles east of here, sank into the river March 24, causing a loss of $50,000.

NEW HAMPTON, IA.—Contracts for water works and an electric light plant have been awarded as follows: To Westinghouse Company for electrical apparatus, $3,000; Filer & Stowell Company, Milwaukee, Wis., engine, $2,500; J. G. Robertson, St. Paul, Minn., boilers, feed pump, etc., $4,850, and Moss & Jackson, Des Moines, steel tower and tank, $4,654.

PERRY, IA.—The Perry Electric Light, Power & Heat Company is planning to establish a day service, and has ordered additional machinery to provide for the extra service.

ROCK VALLEY, IA.—J. C. Wiggerman, town clerk, writes that the citizens on March 25 voted to grant R. A. Talbott a franchise for an electric light plant.

BOWLING GREEN, KY.—The Bowling Green Railway Company is contemplating the purchase of a 150-kw rotary converter in the near future.

COVINGTON, KY.—The citizens are contemplating enlarging the municipal electric lighting plant in the spring. New engines and boilers will be installed. John Craig is manager.

LOUISVILLE, KY.—The Home Telephone Company is contemplating extensive additions to its system in this city.

MT. STERLING, KY.—Representatives of Chicago capitalists have submitted a proposition to the Paris-Mt. Sterling Interurban Company to finance the line and build the electric road. Efforts are being made to comply with the demands of the capitalists, and it now looks as if the road might be built, which will cost, with the equipment, $500,000.

FRANKLIN, LA.—John C. Lewis, Mayor, writes that plans and specifications are being prepared by Warren B. Reed, of New Orleans, for improvements to the electric light plant which will cost about $20,000.

BOSTON, MASS.—The bill to incorporate the People's Electric Lighting Company, of Boston, has been turned down by the legislative committee on public lighting. This bill proposed to permit the establishment of another electric lighting company in Boston to compete with the present Edison Company. The same committee also reported adversely on the petition of Senator Linehan, of Boston, to submit to the voters the question of cities establishing municipal lighting plants upon the petition of30 per cent of the voters.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company has recently purchased new equipment at a cost of $1,000, which will be installed to assist in keeping the voltage up to 2400.

HAVERHILL, MASS.—The Board of Gas and Electric Light Commissioners has sustained the appeal of the Haverhill Electric Company from the decision of the Board of Aldermen of that city in granting to C. H. Hayes rights to lay and maintain wires, cables or conductors for transmitting electricity across Main Street in Bradford and across Washington Street at the points where these streets are crossed by the Boston & Maine Railroad.

LAWRENCE, MASS.—The Board of Aldermen has granted the Pacific Mills permission to cross Broadway with conduits and wires from its proposed power house west of Broadway to the mills. The company proposes to generate electricity to light and operate all of its mills.

LOWELL, MASS.—The Lowell Electric Light Corporation has announced its intention of building a new plant in Belvidere at a cost of $250,000.

MAYNARD, MASS.—The Lowell, Acton & Maynard Street Railway Company reports that it will build 11 miles of track this season.

MIDDLEBORO, MASS.—The new 125-hp engine for the municipal electric lighting plant has arrived and will be installed at once.

NATICK, MASS.—At a recent town meeting the citizens voted to appoint a committee consisting of the Selectmen, together with three citizens to be appointed, to contract with the Edison Electric Illuminating Company for a term of not exceeding one year for lighting the streets of the town on a basis of 2200 hours per year. An appropriation of $4,000 was made for electric lighting, which provides for 15 arc lamps of 1200 candle-power, and 178 incandescent lamps of 25 candle-power.

NEW BEDFORD, MASS.—The Union Street Railway Company expects, during the next three weeks, to contract for considerable material. The company contemplates the purchase of an 800-kw generator and engine and additional rolling stock. The company also expects to build three miles of new track.

NORTH ABINGTON, MASS.—Arrangements are being made to increase the capacity of the plant of the Electric Light & Power Company of Abington and Rockland. The company has recently extended its services to West Hanover, South Hanover, Hanover's Four Corners, and is also contemplating extending its service to North Hanover. In order to meet the increasing demands for electricity the company will install additional machinery.

NORTHAMPTON, MASS.—The Northampton electric lighting plant, which was recently absorbed by the Massachusetts Lighting Companies, is to be doubled in capacity, machinery to cost $100,000 having been ordered. A new turbo-generator set of 300-kw capacity, made by the Allis-Chalmers Company, of Milwaukee, Wis., will replace the 500-hp engine now in use. The system is to be changed from 120 to 60 cycle. The new machinery will also replace three dynamos having a total capacity of 480 kilowatts.

ORANGE, MASS.—At a town meeting held recently the citizens voted to authorize the Selectmen to grant a franchise to the Greenfield, Bernardston & Northfield Railway Company.

ORANGE, MASS.—The new power plant of the Orange Electric Light Company at Wendell Depot has been placed in operation. The new plant can be run by either steam or water power. The steam plant has a capacity of 350 horse-power. The company will establish a day power service about April 10.

PEABODY, MASS.—At a town meeting held March 25, the citizens voted to refer the electric light plant matter back to the committee until next fall.

QUINCY, MASS.—The Quincy Electric Light & Power Company has recently installed a 50-hp motor at the granite works of John L. Quincy, South Quincy.

SPRINGFIELD, MASS.—W. L. Mulligan, manager United Electric Light Company, writes that Casper Ranger, of Holyoke, has secured the contract for the improvements contemplated; probable cost of work, $100,000.

WILLIAMSBURG, MASS.—It is reported that the Mill River Electric Lighting Company will soon be absorbed by the Massachusetts Lighting Companies. If the consolidation takes place the buildings at Williamsburg will be vacated and electricity will be furnished by the Northampton plant.

WORCESTER, MASS.—The Milford Electric Light & Power Company has been incorporated, with a capital stock of $40,000. A. Clarke is president.

ANN ARBOR, MICH.—Work of constructing a new $15,000 power house on the site of the old Lowell paper mill located on the Huron River has commenced. The power plant will have three water wheels, the fall of water being 16½ feet. The contract for the plant calls for its completion December 1. The work is being done by the Edison Company, of Detroit.

BENTON HARBOR, MICH.—At an election held recently the proposition to issue bonds for the construction of an electric light plant and water works was defeated.

CALUMET, MICH.—The citizens of Laurium and Calumet are considering the establishment of a municipal electric light plant.

ESCANABA, MICH.—T. J. Burke, city clerk, writes that all bids opened on March 23 for improvements to the electric light plant have been rejected and new bids will be received. The probable cost is placed at $16,000.

GRAND RAPIDS, MICH.—The M. B. Wheeler Electric Company has been awarded the contract for the wiring and electrical equipment for the new Baxter laundry building. The laundry company will generate all electricity for both power and lighting purposes. The smaller machines in the plant will be direct driven by small motors, while other machines will be grouped and be driven by larger motors.

HOUGHTON, MICH.—The Tamarack Mining Company is installing an electric plant in its mines.

LANSING, MICH.—Plans are now being considered by the electric and water board for increasing the capacity of the municipal electric lighting plant.

LAURIUM, MICH.—Plans are being considered for the construction of an electric lighting plant in this place.

MARQUETTE, MICH.—The annual report of the commission under whose auspices the municipal electric light plant is conducted shows that during the year ending March 13 last a business amounting to $74,335 was done. The total income from the sale of electricity was $50,087. There was expended on new construction nearly $10,000, with $3,210 more on interest account. After allowing liberally for depreciation there is shown a net revenue of $29,136 to the credit of the plant. The commission has on hand now cash to the amount of $30,310, as against $14,562 a year ago, or about one-half the estimated cost of the proposed new plant, to be built this year and which will enable the city to do a considerably larger light and power business. The plant is operated by water power. The rate charged householders is 7 cents, and business places 5 cents per kilowatt-hour.

PORTLAND, MICH.—The Commonwealth Power Company, of Jackson, Mich., has completed its 26-foot dam a few miles down Grand River from Portland, and it is producing 7500 horse-power. The electricity is transmitted to Jackson and from there to Battle Creek and Kalamazoo.

FAIRMONT, MINN.—Bids will be received until April 9 by F. E. Wade, secretary water and light committee, for installing a 225-hp gas producer electric lighting plant.

MENOMINEE, MINN.—The water rights on the Escanaba River, owned by the I. Stephenson Company, have been sold to a corporation composed of Menominee and Appleton paper mill capitalists for $200,000. The new company will construct a 6000-hp plant, which will be in charge of C. L. Hule, of the Menominee & Marinette Traction Company.

MASCOUTAH, MO.—The Looking-glass Prairie Telephone Company has increased its capital stock from $10,000 to $20,000.

PRINCETON, MO.—Clinton H. Ballou has been granted a franchise to operate an electric railway in this city.

ST. LOUIS, MO.—The Samson Light Company has filed an amendment to its articles of incorporation increasing its capital stock from $10,000 to $30,000.

VERSAILLES, MO.—The new owners of the Versailles & Sedalia Railway have completed arrangements to extend the line to Sedalia and south to Springfield.

TONOPAH, NEV.—In order to facilitate the carrying out of the many improvements which the Nevada Power, Mining & Milling Company contemplates, the Nevada-California Power Company has been organized to take over all the property, property rights and assets of the former company. The new company is identical with the old one in ownership, control and management. It has a capitalization of $5,000,000. The new company by its charter is authorized to issue $3,000,000 in bonds. Extensions and improvements have been decided upon, the estimated cost of which has been placed at $1,500,000, and contracts for which have already been let.

CONTOCOOK, N. H.—The Contocook Electric Light Company has purchased the entire plant and paper mill business at West Hopkinton.

HINSDALE, N. H.—Governor Floyd has signed the bill authorizing the Connecticut River Power Company to construct a dam from Coopers Point, Hinsdale, to the Vermont Shore in Vernon. About 12,000 horsepower will be developed and the cost of the work will be about $1,000,000. Henry I. Harriman, of Hyde Park, Mass., and Malcolm G. Chace, of Providence, R. I., are interested.

MANCHESTER, N. H.—A bill has been passed in the State Legislature granting a charter to the Spalding-Jones Power Company to construct a dam 17 ft. high at Moore's Falls, on the Merrimac River, eight miles below Manchester. The company proposes establishing a power station and utilizing a part of this power for a fibre factory. About 10,000 horse-power will be developed.

OSSIPEE, N. H.—The Carroll County delegation at its meeting held at Concord, March 20, voted to install an electric light plant at the county farm buildings in Ossipee, the cost not to exceed $1,500.

EAST ORANGE, N. J.—Bids will be received by Edgar Williams, city clerk, until April 8, for lighting the streets by electricity; also with gas, both Welsbach and open flame lights, for one, three and five years, from June 1, 1907.

ALBANY, N. Y.—The Mead Bill, which provides that the rate to be charged for electricity in the city of Albany shall not exceed 10 cents a kw-hour, was passed by the Senate March 18. The local company is now selling electricity at a much lower rate than provided for in the bill.

ALBANY, N. Y.—The Municipal Gas Company has reduced the price of electric energy from 15 to 12 cents per kw-hour, the price being retroactive to March 1.

ALBION, N. Y.—The A. L. Sweet Electric Light & Power Company has not been granted a franchise in Albion as reported in a recent issue, the Board of Village Trustees having rejected the proposition submitted by the company.

BABYLON, N. Y.—The Town Board has granted to the Huntington Railroad Company a perpetual franchise for the extension and operation of its proposed electric railway over certain streets in the town, where it will connect with the line of the Babylon Street Railroad, which is now owned by the Long Island Railroad Company.

BALLSTON SPA, N. Y.—The Town Board has granted a franchise to the Hudson River Water Power Company to supply electricity for lighting and power to the hamlets of Ballston Lake and Burnt Hills and the territory lying between the two villages. The franchise is for a term of 25 years.

BUFFALO, N. Y.—The Cataract Power & Conduit Company has applied to the City Council for a franchise to lay a power conduit under the city ship canal for the purpose of supplying Picklands, Mather & Company with electricity for operating its plant. The company is planning to supplant its present steam apparatus with electrical machinery for the handling of iron ore. The Cataract Power & Conduit Company will furnish Picklands, Mather & Company with 600 horse-power 24 hours daily for nine months in the year.

COHOES, N. Y.—The Hudson River Electric Power Company has notified the Common Council that it would refuse to accept the franchise to furnish electricity in Cohoes under the prescribed conditions, specifying that the imposed conditions would entail too great expense, asserting that it was unnecessary to lay ducts under all paved streets, as called for in the franchise granted the company.

MECHANICSVILLE, N. Y.—The Hudson Valley Construction Company, of Troy, has secured the contract for constructing a steam turbine power plant at Mechanicsville, N. Y., for generating electricity for operating the Hudson Valley Railway Company and the United Traction Company, of Albany and Troy. Spurs from the main line of the Delaware & Hudson Railroad will run to the property from both north and south, and, according to the plans prepared by J. G. White & Company, of New York City, the engineers, the power station will be erected about 1000 feet north of the dam of the Hudson River Electric Power Company. The Delaware & Hudson Company will spend between $500,000 and $600,000 in the construction of the plant.

NEW YORK, N. Y.—Sealed bids will be received by the Board of Health of New York City until April 10 for furnishing all the labor and furnishing and erecting all the materials necessary or required to complete an underground conduit system and to install a wiring system for electric lighting, fire alarm, watchman's time detector and telephones, together will all work incidental thereto in certain buildings and throughout the grounds of the Willard Parker Hospital, foot of East Sixteenth Street, Borough of Manhattan. The time for the completion of the work and the full performance of the contract is 60 consecutive working days. The amount of security required is 50 per cent of the amount of the bid. Blank forms and further information may be obtained and the plans and drawings may be seen at the office of the chief clerk of the Department of Health, Borough of Manhattan. Thomas Darlington, M.D., is president.

ROSLYN, N. Y.—A franchise has been granted by the Nassau County Board of Supervisors to the Mineola, Roslyn & Port Washington Traction Company to construct and operate an electric railway from the North Hempstead turnpike to Port Washington.

SALAMANCA, N. Y.—George H. Elliott, village clerk, writes that the citizens on March 20 voted to issue $20,000 for water works improvements and $5,000 for improvement of electric light plant.

SENECA FALLS, N. Y.—The Ithaca, Seneca & Interurban Railway Company has applied to the Board of Trustees for a franchise to construct and operate an electric railway in this city.

SHERBURNE, N. Y.—L. Collins, village clerk, writes that bids will probably be received some time this summer for the proposed electric light plant. The probable cost is placed at $15,000. An engineer has not yet been selected.

GRAND FORKS, N. D.—Plans are being considered for rebuilding the municipal electric lighting plant.

GRAND FORKS, N. D.—The building in which the city electric lighting plant was installed was recently destroyed by fire.

BRYAN, OHIO.—The City Council has passed an ordinance to issue bonds for the purpose of buying engines, generators and other equipment and appliances for the municipal electric lighting plant and water works plant. John B. White is Mayor.

GALION, OHIO.—A franchise has been granted by the City Council to the Galion Southern Electric Railway Company. The company has now secured the entire right of way from Galion to Mt. Vernon, via Fredericton, and preliminary work will commence at once.

CANTON, OHIO.—The City Council has granted the Central Heating & Lighting Company a franchise in this city.

MAUMEE, OHIO.—The Stratt Manufacturing Company of Maumee has filed suit in the common pleas court against the Maumee Electric Company for $1,600, said to be due on notes, and for the appointment of a receiver.

NORTH BALTIMORE, OHIO.—The electric lighting plant in this city was recently destroyed by fire, entailing a loss of $25,000.

OBERLIN, OHIO.—The Central Pennsylvania Traction Company contemplates making a number of changes and improvements to its line between this place and Steelton during the coming spring and summer.

EL RENO, OKLA.—The El Reno Electric Light & Power Company is contemplating adding two miles of transmission lines to its system. H. H. Stephens is manager.

SNYDER, OKLA.—The contract for the construction of the water works, electric lighting and sewerage systems, has been awarded to W. W. Cook, of Junction City, Kan.

ASHLAND, ORE.—The Ashland Electric Power & Light Company is now operating its plant by electricity supplied from the plant of the Condor Water & Power Company, at Gold Ray. E. G. O'Brien is manager.

ALBANY, ORE.—Walter Mackay is contemplating the development of a hydro-electric plant, and will build a power house about four miles northwest of where the Marion fork of the North fork of the Satiam River and Marion Lake join. It is stated that the power plant will have a capacity of 32,000 horse-power. Two pipe lines will be constructed to convey the water to the power house.

BAKER CITY, ORE.—The Fremont Power Company, of this city, has increased its capital stock from $300,000 to $500,000.

GOLD HILL, ORE.—The Gold Hill Canal Company is contemplating increasing the capacity of its plant to 4000 horse-power this year, and ultimately to 10,000 horse-power. Daniel Lesley is manager.

IONE, ORE.—We are informed that the city will issue $4,000 in bonds, the proceeds of which will be used to change the municipal electric plant to steam power in the spring. L. E. Coyle is superintendent.

JUNCTION CITY, ORE.—The Howard Electric Light Company is considering installing a large turbo-generator set and an additional boiler in its plant. B. F. Howard is manager.

LEBANON, ORE.—The Lebanon Electric Light & Water Company will install a 100-hp turbine in its plant. J. S. Hughes is manager.

PORTLAND, ORE.—The Pence Company has decided to build a loop interurban electric railway running from Willamette Heights to Linnton, and thence to Portland.

ALTOONA, PA.—The Citizens' Electric Light, Heat & Power Company has been awarded the contracts for furnishing the incandescent lighting for the city.

CHESTER, PA.—The Chester Traction Company has placed a contract with the O'Connell Construction Company for the construction of an electric railway from Pottstown to Boyertown. T. E. O'Connell, of West Chester, is president of the construction company.

CONFLUENCE, PA.—The annual report of the borough electric light plant shows that it has been successfully conducted, with profit to the town. In addition to furnishing the street lamps free, and light to private consumers at a lower rate than is charged at many places, the borough plant earned $115.24 over and above expenses.

ERIE, PA.—The promoters of the Erie, Cambridge, Union-Corry Railway Company are seeking a franchise for a line through this city. The line when completed will be 42 miles long.

HOOVERSVILLE, PA.—Telford Lewis, in charge of the Somerset Mining Company in Hooversville, has applied to the Borough Council for a franchise to supply electricity for lighting for the municipality and to residents.

JOHNSTOWN, PA.—A petition asking for a decree of dissolution of the Consumers' Light, Heat & Power Company, of this city, has been filed in court at Ebensburg. The document sets forth that at a meeting of the stockholders in March, 1903, it was determined to transfer the company's property to the Citizens' Light, Heat & Power Company; that all said property had since been disposed of, and that there are no outstanding obligations against the company at present. The decree was made returnable April 23. Although authorized in 1903, the merging of the Consumers' and Citizens' companies was not completed until last fall.

LANCASTER, PA.—Surveys are being made by the Lancaster County Railway & Light Company for an electric railway between Christiana and Coatesville, for the purpose of extending the Lancaster & Eastern Street Railway Company's system from Christiana to Coatesville, where it will connect with the line for Philadelphia.

MEADVILLE, PA.—The Meadville & Conneaut Lake Traction Company has placed contracts for two 750-hp turbines, with switchboards all complete.

PENNSBURG, PA.—At a special meeting of the Town Council, held March 23, a committee was appointed to have plans prepared for the electric light station and to receive bids for the construction of the plant. Frank G. Ortt, consulting engineer, estimates the cost of the plant, including the site, at not more than $2,500.

PHILADELPHIA, PA.—J. E. and A. L. Perrock have secured the contract for erecting the power plant for the Philadelphia General Electric Company, on Thirteenth Street and Washington Avenue. It will be five stories high, 95 ft. x 130 ft. of reinforced concrete construction, and cost about $110,000.

SCRANTON, PA.—The new owners of the Suburban Electric Light Company are making extensive improvements and additions to its plant. Contracts have been placed for a 1500-kw generator, at a cost of $200,000. Later another generator having a capacity of 500 kilowatts will be installed. The boiler rooms of the local plant of the Suburban Company will be rebuilt. The company plans to spend about $1,250,000 on improvements to the plant within the next three years. George M. Tidd is local manager of the company.

SOUTH BETHLEHEM, PA.—The South Bethlehem & Saucon Electric Railway Company will soon commence work on the construction of the electric road between this place and Centre Valley. C. P. Hoffman is president of the company.

YORK, PA.—The Common Council has passed an ordinance granting the York Street Railway Company a perpetual franchise for a street railway on certain streets and avenues in the city.

PROVIDENCE, R. I.—The Rhode Island Company has purchased a tract of land adjoining the Eddy Street power house and will begin at once the work of enlarging the plant.

BISHOPVILLE, S. C.—We are informed that a new 150-hp engine will be purchased by the Bishopville Light & Power Company. R. W. McLendon is manager.

NEWBERRY, S. C.—A new boiler and engine has recently been installed in the municipal electric lighting plant. F. M. Boyd is manager.

CHATTANOOGA, TENN.—The Chattanooga Electric Company has installed a 1000-kw and also two 300-kw rotary converters to furnish electricity for the Chattanooga Electric Railways Company. As soon as the new machinery is placed and in operation, the Ridgedale plant of the Chattanooga Railways Company will be closed down and held in reserve for emergencies, as the electric company will furnish the railway company with electricity for operating its system.

CLIFTON, TENN.—The Clifton Ice Company will install a 75-hp, four-valve Atlas engine in its plant in the spring. E. B. Walkington is manager.

DAYTON, TENN.—The Rhea County Electric Light Company is contemplating extending its lines to Graysville and wiring the town. T. W. Caudle is manager.

HARRIMAN, TENN.—A 300-kw, three-phase Fort Wayne generator, and an 80-hp Atlas engine have recently been placed in the city water and light plant. C. A. Wallinger is superintendent.

JACKSON, TENN.—The Jackson & Suburban Street Railroad Company is building a new 2200-volt, 60-cycle, three-phase power plant. S. S. Bush is manager.

LA FOLLETT, TENN.—The La Follett Water, Light & Telephone Company is contemplating installing 100 new telephone lines and instruments and 2500 feet of cable. Charles G. Arnold is manager.

LEWISBURG, TENN.—The citizens are contemplating increasing the capacity of the municipal electric lighting plant, and will install a three-phase dynamo and engine some time this year. E. J. McCoy is manager.

MURFREESBORO, TENN.—J. H. Nelson, owner of the city gas and electric lighting plant, is contemplating extending the street lighting system.

PARIS, TENN.—The installation of a 300-hp engine in the municipal water and lighting plant is under consideration. M. W. Younkin is manager.

RIPLEY, TENN.—The Ripley Light, Water & Ice Company will discard its flat rate system and install meters in residences. The rate for electricity will be 10 cents per kw-hour. W. A. McCallam is superintendent.

SPARTA, TENN.—The Sparta Electric Light & Power Company will soon purchase a 60-hp boiler. S. Hayden Young is president.

ARLINGTON, TEX.—A movement is now on foot to reorganize the Arlington Electric Light & Water Company for the purpose of installing a new electric lighting and water works system.

DEL RIO, TEX.—W. H. Wolff, president Del Rio Electric Light & Ice Company, writes that the proposed ice and electric light plant to be installed during the year will cost between $30,000 and $40,000. No bids will be called for.

ELGIN, TEX.—A 30-year franchise has been granted to W. H. Rivers by the Board of Aldermen for an electric light and water works plant.

GILMER, TEX.—A new electric lighting plant will soon be installed in this place. George F. Brockman will have charge of the construction of the plant.

TEMPLE, TEX.—F. E. Merrill has disposed of his holdings in the Temple Electric Light Company to J. E. Ferguson, of this city, and J. Z. Miller, of Benton.

OGDEN, UTAH.—The City Council is considering the question of installing a municipal electric light plant.

SALT LAKE CITY, UTAH.—J. T. Brecken, of Salt Lake City, has made application to appropriate 1000 second-feet of water from Green River for power purposes. It is estimated that 4000 horse-power will be generated. The scheme involves the construction of a masonry dam 25 ft. high across the channel of Green River.

NORFOLK, VA.—The Norfolk & Ocean View Railway Company is preparing to issue $1,500,000 in bonds for additional lines and betterments. S. C. Hathaway is general manager.

RICHMOND, VA.—J. F. Goodwin, of Richmond, president Northside Light & Water Company, writes that it is proposed to construct water works and an electric light plant to supply Chestnut Hill and Highland Park, but nothing definite has been decided upon as yet.

CASTLE ROCK, WASH.—The plant of the Castle Rock Electric Company, which was wrecked by the flood last November, has been repaired and put in operation. The city has been without electric light service for nearly four months.

LEAVENWORTH, WASH.—Bids will be received until April 23 by the Town Council for an electric light and water works franchise. Guy A. Hamilton, town clerk.

NORTH YAKIMA, WASH.—The Yakima Inter-Valley Traction Company has been granted a franchise by the County Commissioners to construct and operate an electric railway from the Moxie district to Zillah, a distance of 24 miles; also west to the city of Wide Hollow.

SEATTLE, WASH.—The Seattle Electric Company has announced another increase in the wages of its trainmen.

SPOKANE, WASH.—Wilbur S. Yearsley, of Spokane, president Pend d'Oreille Development Company, writes that Willard Young and Frank C. Kelsey, of Portland, Ore., are preparing estimates for the proposed plant and will have the same ready about Aug. 1.

SPOKANE, WASH.—The Washington Water Power Company will lay between 300,000 and 400,000 feet of underground ducts for its light and power wires during the coming summer. The ducts have been ordered. All the ducts are to be laid within the fire district and the work contemplated will complete the underground system which was started last year.

TACOMA, WASH.—G. D. Grant has petitioned the Commissioners of Pierce County for permission to construct and operate a system of water works and electric light lines along Lake Boule.

WENATCHEE, WASH.—The Wenatchee Electric Company is contemplating increasing the capacity of its plant and will install additional generating equipment to be operated either by steam or water power. Plans for the work have not yet been made. The stockholders have voted to increase the capital stock to $150,000. Arthur Gunn is manager.

PIEDMONT, W. VA.—Extensive improvements and additions have been made to the plant of the Piedmont Electric Light & Power Company. The company has recently installed a 220-kw Warren alternating-current generator, a 350-hp Russell engine and two new tubular boilers having a capacity of 150 horse-power each. N. I. Hall is manager.

TERRA ALTA, W. VA.—J. J. Jenkins writes that he is contemplating installing a 100-hp engine and boiler and a dynamo of 100 kilowatts capacity in his plant, and will also do considerable wiring inside and out.

WHEELING, W. VA.—Application has been made by the Wheeling Traction Company for a right of way over the public roads for an electric railway to be constructed from Bellaire to Neffs. The proposed line will be built over private right of way, for which surveys have already been made. It is generally understood that the Wheeling Traction Company will construct the road and operate it under the name of the Bellaire & Southwestern Traction Company.

BELOIT, WIS.—The Beloit Water, Gas & Electric Company is planning the installation of 300 kw additional capacity in its plant. E. G. Cawdery is manager.

BRODHEAD, WIS.—The Brodhead Electric Light Company is contemplating increasing the capacity of its plant by the installation of a 60-kw, 220-volt General Electric generator. George M. Pierce is manager.

CAMPBELLSPORT, WIS.—W. L. Anderson, of Pewaukee, has secured a franchise for an electric light plant.

DARLINGTON, WIS.—The Darlington Electric Light & Water Power Company will increase the dynamo capacity of its plant next summer. W. H. Winter is manager.

DELAVAN, WIS.—The Delavan Light & Fuel Company is contemplating making an entire change in the electrical equipment of its plant next summer. H. Ahlson is manager.

ELLSWORTH, WIS.—The Ellsworth Heat, Light & Power Company is changing its plant from steam to water power. N. N. Buck is manager.

FOND DU LAC, WIS.—The East Wisconsin Railway & Light Company will erect a new power house at the bend of the river near Rees and Russells Streets.

FOOTVILLE, WIS.—The Footville Telephone Company has increased its capital stock from $10,000 to $15,000.

GREENWOOD, WIS.—The citizens are contemplating extending the lines of the municipal electric lighting plant to Loyal, a distance of four miles, for the purpose of lighting the town. A. M. White is manager.

HUDSON, WIS.—The Willow River Electric Light & Power Company is contemplating the installation of a 150 to 175-hp alternating-current, three-phase, 60-cycle, 500-r. p. m. belted generator in its plant this spring. T. E. Hanson is manager.

JANESVILLE, WIS.—The Janesville Electric Company is considering the installation of a 200-hp boiler in its plant this year. P. H. Korst is manager.

MADISON, WIS.—The Freistadt & Cedarburg Telephone Company has increased its capital stock from $500 to $3,000.

MADISON, WIS.—The Farmers' New Era Telephone Company has increased its capital stock from $50,000 to $100,000.

MANAWA, WIS.—The Little Wolf River Lumber Company has recently installed a new 100-kw dynamo. The company has been awarded a two-year contract for lighting the village.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has refused to install any more electric lamps for the city. John I. Beggs, in a letter to V. J. Schoenecker, Jr., commissioner of public works, states that the company cannot afford to install more lamps because no assurance is given by the city that the payment on the light will be made for a sufficient length of time to pay for the cost of installation. This position is taken by Mr. Beggs because of the uncertainty of the length of contracts given to the company depending upon the construction of the proposed lighting plant.

AFTON, WYO.—The Afton Electric Light Company has purchased the local electric light plant from B. E. Blusser.

BASIN, WYO.—The Basin Electric Light & Power Company is contemplating the installation of additional boiler of 85 hp in the near future. J. E. Frisby is manager.

CASPER, WYO.—The Casper Electric Light Company is contemplating the erection of a new and larger plant in the near future, and the extension of its lines to the more remote parts of the city. Nathan C. Johnson is manager.

EVANSTON, WYO.—The Evanston Electric Light Company has under consideration the installation of a 150-kw direct-current unit, Corliss engine and two 125-volt machines for operating an Edison three-wire system. The company also operates a district heating system. L. E. Reaney is manager.

NEW CASTLE, WYO.—The installation of an additional dynamo and four motors is under consideration by the New Castle Electric Light Company. J. C. Getchell is manager.

NEW WESTMINSTER, B. C.—The Schaake Machine Works Company are erecting new works which will be operated entirely by electricity.

VANCOUVER, B. C.—The Washington Railway & Power Company, of which Arthur Langguth, Portland, is secretary, has secured franchises from the city of Vancouver, Wash., for an electric railway to run on the principal streets of that city.

VANCOUVER, B. C.—The British Columbia Power & Electric Company, Ltd., has filled an application in the Water Commissioner's office at New Westminster, for 3000 miners' inches of water to be taken from the Squamish River and the Cheakamus River and its tributaries.

PRINCE ALBERT, CAN.—The City Council has decided to develop the electrical power on the Shell River at a cost of $250,000. Address Mayor Shell.

PRINCE ALBERT, CAN.—The City Council has let contracts for the extension of the electric lighting plant to Goldie & McCulloch and the Allis-Chalmers-Bullock Company, both of Montreal, at a cost of $26,237.

PRAIRIE DU CHIEN, WIS.—Plans are being made by the Prairie City Electric Company to install a new Corliss engine of 150 horse-power and a 120-kw alternator, also a new arc lighting system. F. Haupt is superintendent.

VERMILION, CAN.—The Alberta Light & Power Company has decided to install a telephone system in this town. Address Duncan Marshall, Edmonton, Alberta.

COBALT, ONT.—A syndicate is being formed with a capital of $2,000,000 for the purpose of erecting an electrical smelter here at a cost of $500,000. J. H. Reid, of Newark, N. J., is interested.

GALT, ONT.—The Hydro-Electric Power Commission has submitted a schedule of rates for the cost of electric energy to be delivered in Galt as follows: Five horse-power, used 10 hours a day, delivered at factory, all charges included, $31.50 per hp-year; 10 hp, $30; 25 hp, $27; 50 hp, $24; 100 hp, $22.50; 200 hp, $21. This includes all expenses and allows a margin of profit for the municipality. At the above price it is estimated that the all-night, all the year electric lighting of streets will cost only $42 to $45, as against $75 now for 300 nights. Incandescent lighting will cost 5 cents to 7 cents per kw-hour, as against 12 cents to 14 cents now charged.

HAMILTON, ONT.—City Engineer Barrow has received a report from Engineer Aitkin, of Toronto, estimating the cost of installing an electric pump of 9,000,000 gallons daily capacity at $30,000.

OSHAWA, ONT.—The Town Council has granted a 20-year franchise to W. C. Dixon, Ingersoll, to operate electric light and gas plants here.

PETERBOROUGH, ONT.—Plans are now being prepared for an addition to the factory of the Prepayment Electric Meter Company.

JALISCO, MEX.—The San Pedro Analco Mining Company will install on the Santiago River machinery for generation of 450 hp. The power plant will be in operation before the next rainy season sets in.

Company Elections.

PINE BLUFF, ARK.—At the annual meeting of the stockholders of the Citizens' Light & Transit Company, the following directors were elected for the ensuing year: J. F. Rutherford, R. L. Rutherford, J. B. York, Robert York, E. B. Bloom, D. C. Bell, C. H. Samstag, J. S. Ingram and W. T. Young. The board of directors has organized by electing J. F. Rutherford president, J. B. York first vice-president, Robert York second vice-president, W. T. Young secretary, and R. L. Rutherford treasurer.

WILLIMANTIC, CONN.—At the annual meeting of the directors of the Willimantic Gas & Electric Light Company, held recently, the following officers were re-elected: J. F. Church, Willimantic, president; George A. Lewis, Boston, treasurer; D. F. Tilley, Boston, assistant treasurer; C. W. Noyes, Willimantic, secretary.

WARE, MASS.—At the annual meeting of the Ware Electric Light Company held recently, the board of officers was elected as follows: Directors, F. M. Sibley, Andrew Bryson, E. H. Gilbert, H. K. Hyde, C. C. Hitchcock; clerk and treasurer, Dr. G. M. C. Barnard; auditor, William C. Eaton. The directors have chosen Mr. Sibley as president and Mr. Bryson as vice-president from their number.

UTICA, N. Y.—At the annual meeting of stockholders of the Bossert Electric Construction Company, the following directors were elected: D. N. Crouse, F. K. Kernan, Walter N. Kernan, Charles B. Rogers, Beecher M. Crouse, Henry Quin, Frank G. Scofield. The following officers were elected: D. N. Crouse, president; F. K. Kernan, vice-president; Frank G. Scofield, secretary and treasurer.

DELPHOS, OHIO.—At the annual meeting of the Delphos Electric Light & Power Company held recently, T. P. Linn, of Columbus, was elected president; S. D. Chambers, of Delphos, vice-president; Henry Gumble, of Columbus, secretary and treasurer; H. L. Campbell, of Delphos, general manager. The company decided to furnish each church in Delphos with electric light to the amount of $24 a year free, all above that amount to be paid for at regular rates.

MIAMI, OHIO.—At the annual meeting of the Miami Telephone Company the following officers were elected: Glenn C. Frissell, president and general manager; Edward C. Romfh, secretary and treasurer; B. K. Sands, general superintendent.

New Industrial Companies.

THE AMEPERE MANUFACTURING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture electrical appliances. The directors are Leopold Pollock, Nathan Freedman and Theresa Freedman, of New York.

THE CANADIAN FIRE EXTINGUISHER COMPANY, of Toronto, Ont., has been incorporated, with a capital of $40,000, to manufacture fire preventive appliances, electric light and gas fittings, machinery, motors, dynamos, switchboards, faucets, etc. The charter members are: F. W. C. Dickson, J. Murphy, W. Lauder, all of Toronto, Ont.

DEGNON & O'SHEA, of New York, N. Y. (electrical contractors), have been incorporated, with a capital stock of $10,000. The directors are R. E. Degnon, J. E. O'Shea and F. S. Gannon, Jr., of New York, N. Y.

THE EAGAN-FARRY ELECTRICAL COMPANY, of Dallas, Tex., has been incorporated with a capital stock of $15,000. The incorporators are C. H. Eagan, L. R. Wright and R. R. Farry.

THE ELECTRICAL SHOW, of New York, N. Y., has been incorporated, with a capital stock of $30,000. The directors are G. F. Porter, of Newark, N. J.; J. J. Schwartz and D. B. Luckey, of New York, N. Y.

THE GOODSON ELECTRIC MANUFACTURING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $25,000. The directors are W. H. Quinn, of New York, and others.

THE JONES & LANE COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $30,000, and the following directors: J. G. Jones, A. S. Lane and F. S. Thomas, of Rochester, N. Y. The company proposes to manufacture gas engines.

THE KING ELECTRICAL WORKS, of Montreal, Que., has been incorporated with a capital of $30,000 to manufacture brass and copper, electrical machinery, dynamos, switchboards, etc. The charter members include E. F. Surveyor, J. W. Weldon and A. C. Casgrain, all of Montreal, Que.

THE LA COMPANIA EDISON HISPANO-AMERICANO, of Newark, N. J., has been incorporated, with a capital stock of $25,000, by John E. Helm, Hugo Boepple, Jr., and John G. Van Blarcom.

THE NASH THERMOSTATS, LTD., of Toronto, Ont., has been incorporated, with a capital stock of $120,000, to produce heat and light for public buildings and factories. The provisional directors are: A. Mills, W. E. Raney, C. M. Colquhoun, all of Toronto, Ont.

THE NATIONAL ELECTRIC DENTAL MANUFACTURING COMPANY, of Atlanta, N. Y., has been incorporated, with a capital of $100,000. The directors are S. H. Mollesen, J. D. Davidson and C. T. Black, of New York, N. Y.

THE TRENTON GAS & ELECTRIC FIXTURE MANUFACTURING COMPANY, of Trenton, N. J., has been formed, with a capital stock of $50,000, for the purpose of manufacturing gas and electric fixtures. The officers are Charles Reichert, president and treasurer; Charles Gears, secretary; Frank K. Peters, vice-president. The manufacturing plant of the company commenced operation March 21. The company will open a show room in the center of the city and will establish branches in New York and Philadelphia.

New Incorporations.

WETUMPKA, ALA.—The Wetumpka Power Company has been organized with a capital of $6,000. The incorporators are M. Hohenburg, F. W. Lull, F. M. Tate and others.

FRESNO, CAL.—Articles of incorporation have been filed for the San Joaquin Valley Western Railroad with a capital of $6,000,000. The promoters of the road are James Shaw Robertson, of Hanford; Philip McRae, of Armona; J. O. Hickma, of Hanford; A. P. May, of Coalinga; Truman G. Hart and J. A. McClurg, Jr., of Fresno, and others.

MONROVIA, CAL.—The Sierra Madre Telehone Company has been organized with W. E. Farman, president; J. M. Baldwin, vice-president; F. N. Hawes, secretary, and J. H. Baldwin, manager.

CHICAGO, ILL.—Articles of incorporation have been filed for the United Electric Company with a capital stock of $75,000 by Frank Z. Sweet and others.

MT. STERLING, ILL.—The Mt. Sterling Telephone Company has been incorporated, with a capital stock of $12,000, by Alexander H. Clark, Edwin Pendleton and Edward E. Clark.

PEORIA, ILL.—The Morton Light, Heat & Power Company has been incorporated with a capital stock of $18,000, by Henry Beyer, William R. Lockland and others.

SANDWICH, ILL.—The Farmers' Telephone Company has been chartered, with a capital stock of $5,000, by J. C. Knight and others.

VERMILION, ILL.—The Stratton Mutual Telephone Company has been incorporated with a capital stock of $2,500 by Charles Watson and others.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has been incorporated with a capital stock of $25,000,000. This is the holding company for the syndicate headed by Hugh J. McGowan, of this city.

INDIANAPOLIS, IND.—The Grand Central Traction Company, with $250,000 capital stock, has filed articles of incorporation with the Secretary of State. The company proposes to build an electric railway between Indianapolis and Evansville, with a branch line from Bloomington to Terre Haute. The company's office will be in Indianapolis. D. H. Morgan, Ora W. Blickenstaff, William D. Whitney, M. P. Carter and W. D. Duncan are the directors.

LEBANON, IND.—The Big Springs Telephone Company has been incorporated, with its principal exchange at Big Springs. Addison Highbee, Ellis Edwards, F. M. Cobb and J. O. Parr are the directors.

LEWIS, IND.—The Lewis Telephone Company has been incorporated. The capital stock is $10,000. C. C. Givens, president and J. N. Woods, secretary.

McCUTCHVILLE, IND.—The Southern Indiana Telephone Company has been incorporated with a capital stock of $10,000. The directors are Philip H. Kippel, Theodore H. Umbech and Daniel Crisp.

SOUTH BEND, IND.—The Southern Electric Construction Company has been incorporated, with a capital of $100,000, to build an electric railway from Washington to Martinsville, Ind., and to construct and operate plants in both cities and intermediate places, for the generating and distribution of electricity for heat, light and power. T. D. Moore, Chicago; J. F. Noel, South Bend, and O. H. Gabel, Indianapolis, are the incorporators.

DAVENPORT, IA.—The Davenport & Burlington Interurban Railway Company has been organized with a capital stock of $250,000. The object of the company is the construction of an interurban line from Davenport by way of Muscatine to Burlington. The incorporators and directors are: C. G. Hipwell, Thos. Dougherty and A. E. Carroll, of Davenport.

DUNKERTON, IA.—The North Dunkerton Telephone Company has been incorporated with a capital stock of $5,000 and the following officers: Thomas Dunkerton, president; H. H. Meyers, vice-president; F. O. Dunkerton, secretary and treasurer.

MARENGO, IA.—The Marengo & Midland Railway Company has been organized in this city. The preliminary capital stock authorized is $25,000. The parties interested are: Henry Dods, H. H. Brimmer, W. E. Hibbs, D. M. Rowland, H. M. Havner, B. C. Leib, W. J. Sayers, J. H. Lewis, H. T. Oldaker, Thomas Stapleton, S. R. Swan, T. P. McGiverin, J. Delaney, A. M. Henderson and E. L. Ives.

WILLIAMSBURG, IA.—The Williamsburg & Iowa City Railway Company has been incorporated, with a capital stock of $10,000. A large number of the citizens of Williamsburg and farmers in this vicinity are among the incorporators.

PITTSBURG, KAN.—The Girard Electric Coal Belt Railway Company has been incorporated. The officers are: James McFarland, president; J. A. Wayland, vice-president; L. H. Phillips, secretary, and Howard C. Leopard, treasurer.

YALE, KAN.—Articles of incorporation have been filed for the Yale Telephone Company by West Keeler, of Thaddus, and Wilbur and Selden J. Spencer.

LOUISVILLE, KY.—The George G. Fetter Lighting & Heating Company has been chartered, with a capital stock of $100,000. The incorporators are George G. Fetter, Howard Wedekemper and others.

FREDERICK, MD.—Articles of incorporation have been filed for the Frederick Interurban Railroad Company with a capital stock of $1,000,000 by Emery L. Coblentz, Thomas H. Halley, Richard P. Ross, James E. Ingram, Jr., and Robert P. Graham.

HOUGHTON, MICH.—The Mutual Water, Light & Power Company, of Houghton, has been incorporated with a capital of $500,000, by Norman W. Haire, Jas. Looney, Herman Wieder, and others.

MENOMINEE, MICH.—The Holmes Lighting & Power Company has been incorporated with a capital stock of $350,000. The incorporators are Herman Holmes, of Crystal Falls; William Holmes, of Menominee; Guy Holmes, of Marinette, and Herbert A. Bowdish, of Fond Du Lac. The company is formed for the purpose of improving the water power at the Grand Rapids of the Menominee River to generate electricity for power, lighting and heat.

SAGINAW, MICH.—The Valley Telephone Company has been reorganized and the following directors elected: E. P. Waldron, of Saginaw; J. P. Kidd, of Ithaca; R. B. McPherson, of Howell, and William B. Woodbury, of Detroit, were chosen as the new board. E. T. Carrington, of Bay City, was elected president. A committee consisting of J. P. Kidd, John L. Jackson, C. O. Trask, H. A. Price and W. B. Woodbury was appointed to attend to the matter of rebuilding the Saginaw exchange.

BELLEVILLE, MO.—The Belleville & Interurban Railroad Company has been chartered with a capital stock of $100,000 for the purpose of constructing an electric railway from Belleville to Smithton. The incorporators are: Jacob Gundlach, Jr., Benjamin A. Gundlach, R. W. Hofsommer, George Hippard and Thomas A. Ball.

DWIGHT, MO.—The Home Telephone Company has been incorporated with a capital stock of $1,500 by R. E. Bunting, John Hoffman and M. B. Butz.

FULTON, MO.—Articles of incorporation have been filed for the Fulton Telephone Company with a capital stock of $2,500 by W. H. Durkee, Robert Ritchie and Garrett Haniga.

PLEASANT CITY, MO.—The Pleasant City Farmers' Telephone Company has been incorporated with a capital stock of $2,000 by J. Larrick and others.

SULLIVAN, MO.—The Sullivan Mutual Telephone & Telegraph Company has been incorporated with a capital stock of $17,500 by G. E. Harsh, J. C. White and W. L. Sickafuss.

WINONA, MO.—The Current River Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are J. V. Chilton and others.

DELL, MONT.—The Dell Telephone Company has been incorporated with a capital stock of $10,000.

OMAHA, NEB.—The Electric Service Company has been incorporated with a capital stock of $50,000 for the purpose of supplying electricity for lighting and power purposes in the towns of Blue Springs and Wymore. The incorporators are Henry T. Clarke and others.

CLAREMONT, N. H.—The Claremont Power Company has been incorporated by L. N. Wheelock, Oscar B. Rand, Hira R. Beckwith, John T. Emerson, Frank H. Foster and Frank H. Brown. This is the third corporation formed to develop the water power at Cavendish Gorge, Vt. The principal organization, the Claremont Railway & Lighting Company, was followed in 1904 by the Black River Power, Lighting & Railway Company. The three companies are closely identified in personnel and management.

JERSEY CITY, N. J.—The Pennsylvania Telephone Company of New Jersey has been incorporated to construct telephone and telegraph lines in Pennsylvania.

TRENTON, N. J.—The Wildwood Electric & Traction Company has been incorporated with a capital stock of $1,000,000 by William J. Classon and others.

BEAVER FALLS, N. Y.—The Beaver River Light & Power Company, of Beaver Falls, has been chartered to carry on operations in the villages of Lowville, Beaver Falls, Croghan and Castorland and the towns of Lowville, New Bremen, Croghan and Denmark; capital $40,000. The directors are J. P. Lewis, H. L. VanArnam and H. S. VanArnam, of Beaver Falls, and N. W. Holt, of Lowville.

BEDFORD, N. Y.—Articles of incorporation have been filed for the Central Electric Light Company by Charles Haines and others. The capital stock of the company is $5,000.

BINGHAMTON, N. Y.—The G. Q. Moon Power Company has been incorporated with a capital stock of $40,000 by W. J. Moon and others.

BUFFALO, N. Y.—The Hinsdale Telephone Company has been incorporated with a capital stock of $5,000 by George S. Beebe and others.

CALLICOON, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Western Sullivan Telephone & Telegraph Company with a capital stock of $25,000. The directors are Valentine Schneidell, of Jeffersonville; Louis Bauerfiends, of North Branch, and F. S. Anderson, of Callicoon.

ITHACA, N. Y.—The Cayuga Southern Telephone Company has been incorporated with a capital stock of $50,000. The directors are R. B. Fegan, Samuel Jeffrey, L. H. Williams and G. W. Jeffrey, of Ithaca, and Isaac P. Hazard, Jr., and Charles M. Hazard, of Popular Ridge.

NEW YORK, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Western Sullivan Telephone & Telegraph Company by Valentine Scheidel and others. The company is capitalized at $25,000.

NEW YORK, N. Y.—The De Forest Radio Telephone Company has filed articles of incorporation with the Secretary of State with a capital stock of $200,000. The directors are S. E. Darby, E. G. Sammis, of New York, and H. S. Mott, of Northport.

HARRISBURG, PA.—A charter has been granted to the Burgettstown, Florence & Paris Street Railway Company with a capital of $66,000. The directors are Chas. W. Dahlinger, Pittsburg, president; John W. Thomas, Robert L. James, A. H. Mercer, L. W. Bigham. The line will extend from Burgettstown to the Pennsylvania-West Virginia State line via Florence.

PITTSBURG, PA.—Articles of incorporation have been filed for the Arnold City & Southern Railway Company, with a capital stock of $45,000. The line will be about eight miles in length and will extend through Washington and Jefferson townships. Edmond Englert, of Pittsburg, is president.

PITTSBURG, PA.—The Squirrel Hill Street Railway Company has been chartered with a capital stock of $15,000, to build an electric railway in this city. Moulton J. Hosack is president, and the directors are Roger Knox, James M. Mager, C. K. Robinson and W. D. McBryar, of Pittsburg.

CASCADE SPRINGS, S. D.—The Cascade Telephone Company has filed articles of incorporation with a capital stock of $1,500.

CENTERVILLE, S. D.—The Centerville Telephone Exchange Company has been incorporated with a capital stock of $50,000 by Frank Dirks and others.

CONDE, S. D.—The Conde Telephone Company has been incorporated with a capital stock of $50,000.

EUREKA, S. D.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $15,000.

DRESDEN, TENN.—The Weakley County Rural Telephone Company is being organized here to connect Latham, Dukedom, Palmersville and Fulton, Ky., with rural telephone systems.

GALENA, TEX.—The Wildcat Telephone Company has been incorporated, with a capital stock of $2,500, by J. G. Corbin and others.

ROANOKE, VA.—The Roanoke Traction Company has been incorporated, with a capital stock of $40,000, for the purpose of constructing an electric railway in this city. U. Markey is president.

PULLMAN, WASH.—The Breeze-Burgan Telephone Company has been incorporated with a capital stock of $3,000 by S. H. Breeze and others.

RICHMOND BEACH, WASH.—The Richmond Beach Telephone & Power Company has been incorporated, with a capital stock of $15,000, by Henry Parry and others.

BRIGGSVILLE, WIS.—The Briggsville & Big Spring Telephone Company has been incorporated with a capital stock of $2,000 by F. J. Kimball and others.

CRYSTAL LAKE, WIS.—The Rural Telephone Company has been incorporated with a capital stock of $1,000 by I. A. Ham and others.

RIPON, WIS.—The Ripon Rural Telephone Company has been incorporated with a capital stock of $10,000 by J. B. Barlow and others.

COBALT, ONT.—The Silver Belt Electric Railroad Company has been incorporated to construct electric railways from here to Latchford, Haileybury and New Liskeard. Branches will be also built to a number of mining camps.

Legal.

AUTHORITY OF CORPORATIONS TO ENTER INTO PARTNERSHIP.—A corporation has no authority to become a partner in any transaction unless such power is conferred upon it by its charter. But where a corporation does enter into a partnership arrangement, for instance, to build and operate an electric amusement park, the corporation will be held liable as a partner to such third persons as are thereby induced to lend credit to the firm. Breinig vs. Sparrow, Appellate Court of Indiana, 80 N. E. Rep. 37.

ACTION TO RECOVER BALANCE DUE FROM ELECTRIC POWER FURNISHED.—In an action brought by an electric light and power company to recover the balance actually due for electric power which had been furnished to one of the company's customers it appeared that, owing to a mistake in book-keeping, bills had been regularly rendered to the defendant for but one-half of the amount of electricity actually supplied. Through an error on the part of one of the plaintiff's book-keepers the meter installed in the defendant's building was described in the books of the company as "½ constant," whereas the meter was in fact "o constant." This description of the meter indicated that the meter reading should be divided by two in order to ascertain the actual amount of energy furnished, and the defendant was accordingly charged but one-half the amount which should have been charged against him. The action for the balance claimed due was defended on the ground that the mistake was due to the carelessness and negligence of the plaintiff. It was held that the plaintiff was entitled to recover and that the defense interposed was invalid, for if such a defense were allowed to stand, then the power of the courts to administer relief on account of the mistakes of book-keepers and other employes of commercial firms would be practically nil, for it could be truthfully said, in every such case, that the mistake resulted from carelessness or inattention. There is no rule of law requiring absolute accuracy in such matters or in any other human transaction. On the contrary, a plaintiff is entitled to relief when it is made to appear that he has innocently and inadvertently made a mistake which has caused him injury and resulted in profit to the opposite party, provided the latter, in innocence of the mistake, has not so changed his position that to correct it would be unjust to him. Union Electric Light & Power Company, St. Louis (Mo.) Court of Appeals, 99 S. W. Rep. 804

RIGHT TO RECOVER DAMAGES FOR DEATH OF PERSON FROM CONTACT WITH LIVE WIRE.—An action brought against a telephone company to recover damages for the death of her husband, due to his coming in contact with one of the company's wires, presents an interesting sequence of facts, upon which the court determined that the company was liable. The telephone company's wires, which carried a harmless current of electricity, were strung on the same poles with the heavily charged wires of a lighting and power company in such manner that, in case of a break in one of the defendant's wires, it would fall upon the wires of the lighting and power company. One of the defendant's wires broke in some unexplained manner at a point over one of the streets of the city of Houston, Tex., and falling upon the wires of the lighting company, hung down into the street. The break occurred in the evening and early the next morning a mule being driven along the street came in contact with the fallen wire and was knocked down and slightly injured. The driver of the mule broke the wire to extricate the animal and, in order to remove the wire from the street where it lay, wrapped it around a post to which was attached a guy wire of the lighting and power company. It is not explained how the mule driver managed to accomplish this without injury to himself, but about two hours later the plaintiff's husband, while in the act of hitching his horse to the post, came in contact with the wire and was killed. It was held that the facts shown established negligence on the part of the defendant telephone company and that the plaintiff was entitled to recover damages. It was the duty of the telephone company to maintain its system of electric wires so that they should not endanger the lives of others or interfere with their lawful use of the public highway. It was its duty primarily to keep its wires off the street and if by any chance any of its wires should happen to be broken, and through such condition become liable to cause injury, it was its duty to exercise ordinary care and diligence to ascertain such fact and to remedy the defect. These duties come under the head of non-assignable duties and, injury having resulted from the failure to perform such duties, the company could not escape liability on the plea that the failure was due to the negligence of its agents or servants. Citizens' Telephone Company vs. Thomas, Court of Civil Appeals of Texas, 99 S. W. Rep. 879.

LIABILITY OF STREET CAR COMPANY FOR INJURIES RESULTING FROM BURNING OF FUSE.—In an action against a street railroad company to recover damages for injuries which were received during the commotion on one of the defendant company's cars, which followed explosions and flashes of light alleged to have occurred beneath the car and in the controller box, there was evidence that the explosions were of an unusual and terrifying character and that a panic was created among the passengers who, in their efforts to get out of the car, crushed the plaintiff against one of the seats of the car and injured her. On the part of the company it was testified that the explosions were due to the blowing out of the circuit breaker and that, instead of being unusual in character, they were such as are of common occurrence and necessarily incident to the operation of electric cars. The court of first instance instructed the jury that if an explosion occurred in the machinery of the car, causing a panic among the passengers, during which the plaintiff was injured without fault on her part, then the burden was upon the defendant to prove that the machinery was safe and sound and that the explosion was caused by inevitable accident which could not have been avoided by the exercise of the highest degree of care. The jury returned a verdict of $2,250 in favor of the plaintiff. But upon appeal the decision was reversed for the reason that the instruction to the jury was erroneous in that it allowed the jury to infer that the company was negligent from the fact that there had been an explosion in its car. There are some accidents which of themselves proclaim negligence on the part of the company, such for instance as the collision of two cars or the overturning of a car. But the ordinary burning out of a fuse is not a ground for presuming negligence, and in view of the fact that it was shown on behalf of the defendant company that the accident which occurred was one which often happens on electric cars, even when well constructed and operated, the defendant should not have been burdened with the necessity of acquitting itself of blame. Trotter vs. St. Louis & Suburban Railway Company, St. Louis Court of Appeals (Mo.), 99 S. W. Rep. 508.

ELECTRIC LIGHTING COMPANY MUST TAKE NOTICE OF HABIT OF SMALL BOYS TO CLIMB TREES.—In an action by a boy, ten years of age, to recover damages for injuries received by coming in contact with one of the defendant's live wires, it appeared that the plaintiff came in contact with the wire, from which the insulation had negligently been removed, while climbing among the branches of an oak tree through which the wire passed. The defendant contended that it could not reasonably have been expected to anticipate that the small boys of the neighborhood would climb the tree and that one of them might be injured while doing so. Upon that point the court said: "The fact that such boy would, in all probability, climb that particular tree, being the particular kind of tree it was, was a fact which, according to every sound principle of law and common sense, this corporation must have anticipated. The argument that it did not almost suggests the query whether the individuals composing this corporation, its

employes and agents, had forgotten that they were once small boys themselves. The immemorial habit of small boys to climb little oak trees filled with abundant branches reaching almost to the ground is a habit which corporations, stretching their wires over such trees, must take notice of." It was held that the company was legally responsible for the injury. Temple vs. McComb City Electric Light & Power Company, Supreme Court of Mississippi, 42 So. Rep. 874.

LIABILITY FOR INJURY TO LINEMAN RESULTING FROM CONTACT WITH FEED WIRE.—A complaint filed against a telegraph company and an electric railway company alleged that the plaintiff was a lineman in the employ of the telegraph company. He was directed by his employers to string two telegraph wires upon a line of poles which already carried three feed wires belonging to the railway company. These feed wires were similar in appearance and size to the copper wire ordinarily used for telegraph and telephone purposes, but they transmitted a current of 5500 volts. They were strung at a point several feet below the tops of the poles and were uninsulated. The plaintiff was instructed by the foreman in charge of the work to climb one of the poles and as the arms prepared for the wires which he was about to string were placed above the feed wires, the plaintiff necessarily came in contact with the latter while climbing the pole. As he did so, he fell backwards, freeing himself from the feed wires, and his belt caught on one of the iron steps of the pole, where he hung until he was taken down by his fellow workman. The contact resulted in serious injury to him by being burned and shocked. From the evidence it appeared that it was the ordinary practice of those engaged in stringing electric wires to place wires carrying dangerous currents of electricity above all other wires, and that, when a lineman saw a wire fastened below telegraph or telephone wires, it was an indication that such wire was not dangerous. The plaintiff testified that he did not know that any of the wires on the pole carried high currents; that there was no sign or warning upon the pole indicating the dangerous character of the wires, and that he had received no other notice of their presence. It was shown that the foreman had knowledge of the position of and danger connected with the feed wires and it was held that his knowledge constituted knowledge on the part of the company so as to make it the duty of the company to warn its employes in regard to the feed wires. In determining that the defendants were liable for the plaintiff's injuries it was held that the plaintiff had not assumed the risk of the danger from which he was injured. A servant assumes only the ordinary risks incident to his employment and such dangers as are obvious and apparent. Danger from feed wires attached to a pole at a point below telephone wires was shown not to be one of the ordinary risks incident to the employment of a line man. In their position they constituted an unusual risk and the danger was neither obvious nor apparent. A verdict for $25,000 was rendered in favor of the plaintiff. Postal Telegraph Cable Company vs. Likes, Supreme Court of Illinois, 80 N. E. Rep. 136.

Educational.

OHIO STATE UNIVERSITY.—Impressive testimony to the fame of Milwaukee as a manufacturing center of machinery and electrical apparatus is given every little while by the descent upon the Cream City of parties of students from technical schools, eager to supplement the knowledge gained in class rooms with an insight into the practical side of their profession. The latest party of students to visit Milwaukee were the "electricals" of the Ohio State University. The students left Columbus, Ohio, on March 24 and returned to the University March 31. A third of the time allotted to their trip was spent in Milwaukee, among the other cities visited being Chicago and Cincinnati. While in Milwaukee the students were the guests of the Allis-Chalmers Company at a luncheon given at the club house at West Allis. While in Milwaukee they also visited the works of the Cutler-Hammer Manufacturing Company, where they were photographed. The party was in charge of Prof. Francis Cary Caldwell and consisted of the following students: N. R. Work, J. L. Grant, R. W. Hall, Carl E. Pool, W. S. Williams, H. W. Conrad, Chas. P. Cooper, J. G. Stewart, D. S. Moore, H. A. Seabright, W. H. Steuve, C. P. Galleher, S. E. Gillespie, Wm. E. Larzelere, Chas. W. Yerger, Jas. Y. Haring, R. E. Hecker, Geo. B. Thomas, H. M. Olds, G. L. Eiselstein, W. O. Dean, M. B. Evans, Frank W. Funk, O. G. Galland, R. R. Penn, A. H. Heitmann, R. R. Hazlitt, H. I. Dodson, John C. Slager, L. W. Roush, J. I. Sample, G. B. Schneeberger, E. R. Dike, C. T. Evans, E. A. Cooke, Wm. G. Mullin, H. A. Cowgill, E. E. Moore, F. A. Zink, M. Erlanger, L. Ridenour, H. S. Knerr, Lee H. Shinkle, and H. M. Grossman.

Obituary.

MR. A. D. NEWTON.—Mr. Arthur D. Newton, manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company, died on Wednesday, March 13, from an attack of the grippe. Mr. Newton had many close business and personal friends throughout the New England States, who will regret exceedingly to learn of his sudden death.

MR. C. M. BRIGHAM, night manager of the Western Union Telegraph Company at Toledo, Ohio, died at his home in that city recently as a result of a stroke of apoplexy sustained a few hours before. Mr. Brigham was born in Toledo 56 years ago and for 30 years had been connected with the Western Union. He was also interested with Homer T. Yaryan in his heating and lighting business. He is survived by a wife and one son.

Personal.

MR. SYLVANUS O. SCHOONMAKER has been elected a director of the American Telephone & Telegraph Company, succeeding Mr. Charles B. Bowditch.

MR. ALBERT UHL has resigned his position with the Woods Electric Company, of Houston, Tex., on account of ill health, and has gone to El Paso to recuperate.

MR. M. S. CONNER, of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has just returned from a six weeks' trip in Europe, where he went to look after the rapidly growing foreign business of his company.

MR. FRANK L. BEAM, manager of the Ohio Independent Telephone Association, has appointed committees to look after the independent movement and arrange for conventions in each district, into which the State is divided.

MR. C. MAHER, for some years chief lineman of the Home Telephone Company, of Toledo, Ohio, has been chosen as manager of the Fisher Electrical Company of that city. Besides his other work Mr. Maher has charge of the outside electrical work of the Toledo Railways & Light Company.

MR. EDWIN W. GOROM has resigned his position as manager for the Grayson County Telephone Company, of Denison, Tex., and has accepted a position with the San Angelo Telephone Company at San Angelo, Tex. Mr. Gorom has been in the telephone business many years and is a telephone engineer as well as a manager of telephone properties.

MR. MARTIN LOEWNIG, of 334 Carondelet Street, New Orleans, La., has formed a partnership with Mr. P. B. Jones, C. E., under the firm name of Loewnig & Jones, as consulting illuminating engineers. The field is a new one in the far South. Mr. Loewnig will continue his expert work for the Mutual Insurance Company, of New Orleans.

MR. ROBERT C. SHAAL, formerly with the General Storage Battery Company, of New York, has accepted the position of sales engineer of the Bliss Electric Car Lighting Company, as assistant to the vice-president, Col. John T. Dickinson, with headquarters at the company's New York offices, Night and Day Bank Building, Fifth Avenue and Forty-Fourth Street.

MR. A. J. KENNEDY, who has been with the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., for a number of years, in its engineering and later in its sales department, has associated himself with the Wire & Telephone Company of America, as traveling representative of its sales department. Mr. Kennedy has a broad acquaintance in the telephone field.

MR. E. DOUGLASS.—Mr. Egbert Douglass has resigned his position as electrical engineer for the Cataract Power & Conduit Company to become prominently associated with the bond-selling department of the Electric Bond & Share Company, of New York. Mr. Douglass left Buffalo on April 1. He went there about four years ago from the General Electric Company's plant at Schenectady and reorganized the power plants for the Cataract Company and the Buffalo General Electric Company. Mr. August Smith, from Schenectady, will succeed Mr. Douglass.

MR. J. F. GARDENER.—Mr. Joseph F. Gardener, for the past four years employed by the Pittsfield (Mass.) Electric Company, and in charge of its electric service and new business departments, has resigned his position to take effect April 1. Mr. Gardener has taken a position with the firm of W. R. Gardener Co., of Pittsfield, who are general agents of the Associated Trust of Boston and the Title Guarantee & Trust Company, of New York. The investment business of the above concern has grown to such proportions that it was found necessary to make a special department which will be known as the investment department. Mr. J. F. Gardener will have charge of this department.

PROF. D. C. JACKSON.—Prof. Dugald C. Jackson, of the electrical engineering department of the Massachusetts Institute of Technology, has been selected as the third member of the special commission to arbitrate on the price to be paid by the city of Boston to the Edison Electric Lighting Company for lighting the streets and public buildings. The other members of the commission are Excise Commissioner Samuel H. Hudson, appointed by the Mayor, and Herbert A. Wagner, selected by the Edison Company. Mr. Hudson and Mr. Wagner selected Professor Jackson. This commission is provided for in the contract now existing between the city of Boston and the Edison Company, with the power to reduce the price paid by the city should it find that the charges are excessive.

MR. ANDREW KEISER, assistant superintendent of the Pittsburg Division of the Pennsylvania Railroad, succeeds Mr. Morrow as superintendent of the new West Penn Division. He started in the service of the Pennsylvania as a messenger boy in 1878. Since that time he has been telegraph operator, yard master, train dispatcher, chief train dispatcher, assistant freight trainmaster, division operator and passenger trainmaster. He was made superintendent of telegraph on June 1, 1903, and in February, 1905, was made assistant superintendent of the Pittsburg Division. Mr. Daniel C. Stewart leaves the office of superintendent

of telegraph to become assistant superintendent of the Pittsburg Division. He is 45 years old, and since 1878 has been in the employ of the company as mail carrier, telegraph operator, train dispatcher, division operator and passenger trainmaster. He was appointed superintendent of telegraph on March 1, 1905. Mr. John B. Fisher succeeds Mr. Stewart as superintendent of telegraph. He is 43 years of age, and has been with the Pennsylvania Railroad since 1883, with the exception of three months during the Spanish War. He leaves the position of freight trainmaster of the Middle Division.

Trade Publications.

STEAM TURBINE ENGINEERING.—The McGraw Publishing Company has issued a list of books relative to the steam turbine which includes fourteen titles of books on this subject which in the past few years have been printed in English. The list does not include the books on the subject published in the German language, which number nearly a score.

ENCLOSED ENGINES.—A revised edition of Bulletin No. 125 in the Sturtevant Engineering Series has just been issued by the B. F. Sturtevant Company, of Boston, Mass. It describes the line of vertical forced-lubrication enclosed engines which this company manufactures in eighteen different sizes ranging from 5x5 to 12x10. A sectional view makes clear the method of positive lubrication.

GAIL-WEBB FIXTURES.—The Gail-Webb Manufacturing Company, of Buffalo, N. Y., has brought out a neat oblong small-size catalogue in regard to its adjustable electric fixtures and portables. These goods have been illustrated and described in our pages quite fully, and mark a distinct advance in apparatus and methods for securing the efficient use of illuminants. The basic idea involved is that of bringing the lamp to the work, instead of trying to take the work to the lamp; and these ingenious fixtures and holders, permitting play and adjustment in every direction, are ideal for shops, drafting boards, libraries, stores, etc. The different varieties are all brought to notice in this catalogue.

MINIATURE BULLETINS.—Miniature bulletins Nos. 4002, 4003 and 4004 have been issued on the subjects of "Allis-Chalmers Direct Current Motors and Generators," "Electric Hoists" and "Polyphase Induction Motors," respectively. These are designed primarily as envelope enclosures and do not profess to give any very detailed description of machines; nevertheless, the reading of them should be sufficient to stimulate interest in the subject mentioned. For the busy man of to-day "condensed" advertising matter, especially when offered in such form that it can be slipped into one's pocket and examined at odd moments, is frequently of much more benefit to the manufacturer than more elaborate and expensive publications.

SOMETHING FOR EVERYBODY.—The Manhattan Electrical Supply Company, 17 Park Place, New York City, has just issued a condensed catalogue No. 22 which is called and embraces "Something Electrical for Everybody." It contains 144 pages and over 750 illustrations of goods manufactured and handled by the concern and is the most comprehensive catalogue for its size ever published, including as it does electrical products in all branches, viz., electricians' supplies, telegraph instruments and supplies, automobile and motor boat sundries, telephones and telephone supplies, electrical novelties, burglar and fire alarms, automatic gas lighting specialties, linemen's equipment, medical apparatus and laboratory supplies—in fact anything and everything pertaining to electricity.

Business Notes.

ROSENBAUM & STOCKBRIDGE.—The patent law firm of Rosenbaum & Stockbridge, which has been located at 140 Nassau Street, New York City, moved into new offices at 41 Park Row on April 1.

PHŒNIX ELECTRIC COMPANY.—The Phœnix Electric Comnay, of Mansfield, Ohio, has opened an office at 83 West Jackson Boulevard, Chicago, Ill., where it will carry a stock of motors and dynamos. The office is in charge of Mr. John Nangle, formerly salesman for the Western Electric Company.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, of Hartford, Conn., is opening an office at 602 Fisher Building, Chicago, where it intends carrying a full line of standard reflectors, miniature, gem and tantalum incandescent lamps. Mr. Charles N. Thorpe has been appointed manager.

THE ELECTRICAL WORLD has opened an office in San Francisco this week under the management of Mr. Herbert Booth King, who is well known on the Pacific Coast. The address is 701 Atlas Building, 604 Mission Street. Copies of the paper and of the books and publications of the McGraw Publishing Company will be carried in stock for the convenience of our friends on the Pacific Coast. The Pacific Coast interests are thoroughly covered by the Electrical World, which is national in character.

WIRE & TELEPHONE COMPANY OF AMERICA.—It has come to the attention of the Wire & Telephone Company of America, at Rome, N. Y., that since the fire which destroyed a portion of its plant on Feb. 23, 1907, reports have been circulated that this will affect them in taking care of the requirements of its trade. This company is particularly anxious to have the trade know that the fire will in no way hamper it in the delivery of its various products. The fire destroyed only that part of its plant in which bare copper wire was drawn, and immediate arrangements were made for the drawing of its copper by other mills. The Wire & Telephone Company of America was just about to erect a large addition to its plant, which, in connection with the rebuilding of its wire mill, is now well under way. When these buildings are completed the company will have one of the most modern wire manufacturing plants in connection with another new and modern building to take care of its telephone business. The new buildings in course of erection will be of brick and steel construction, absolutely fireproof. The entire manufacturing plant will be equipped with a sprinkler system, connection with a pumping station of its own and water tanks of sufficient capacity for fire protection. Its entire manufacturing plant, including present works, will be operated by electric power, the equipment being so arranged that the machinery can be driven independently in groups. The handling of copper throughout the works will be done by pneumatic hoists, and all machinery and equipment will be such as experience has demonstrated to be best adapted for the economical production of high-class work.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Philadelphia, May 2, 3 and 4, 1907.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies' Building, 29 West 39th St., New York. Meetings, fourth Friday of each month.

American Street and Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, Engineering Societies' Building, 29 West 39th St., New York. Spring meeting, Indianapolis, Ind., May, 1907.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Detroit, Mich., third Wednesday, September, 1907.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, Engineering Societies' Building, 29 West 39th St., New York.

Association of Edison Illuminating Companies. Secretary, George R. Stetson, New Bedford, Mass.

Association of Electric Lighting Engineers of New England. Secretary, Wells E. Holmes, 308 Washington St., Newton, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting Atlantic City, N. J., June 19, 1907.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, T. S. Young, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W. Toronto, Ont.

Central Electric Railway Association. Secretary, W. F. Mulholland, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col. Next meeting, September, 1907.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago.

Electrical Trades Association of Canada. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, R. A. Davidson, 58 William St., New York. Next meeting, November, 1907.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York, second Friday of each month.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, L. B. Spinney, Iowa State College, Ames, Ia. Next meeting, Clinton, Ia., April 18 and 19, 1907.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Clinton, Ia., May, 1907.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Houck McHenry, Jefferson City, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa. Next meeting, Washington, D. C., June 4, 5, 6 and 7, 1907.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y. Next meeting, New York City, July 17, 18 and 19, 1907.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next annual meeting, Chicago, second Thursday in June, 1907.

NATIONAL INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y. Next meeting, Syracuse, N. Y., June, 1907.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Toledo, Aug. 20 and 22, 1907.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, 104 Canal St., Cleveland, O.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Charles W. Ford, Oklahoma City, Okla. First annual convention, Oklahoma City, April 22 and 23.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Niagara Falls, N. Y., 1907.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings second Saturday of each month.

PUBLIC UTILITIES ASSOCIATION OF INDIANA. Secretary, J. A. Shunk, Peru, Ind. Regular meetings, second Thursday in May and December.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass. Next meeting, March, 1907.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 26, 1907.

[Conducted by Rosenbaum & Stockbridge, Patent Attorneys, 41 Park Row, New York.]

848,006. ELECTRIC CONTROLLER; Roy W. Brown, Amsterdam, N. Y. App. filed April 19, 1906. A form of electric controller having resistances mounted in the body thereof and enclosed within a hollow drum, on the surface of which are mounted the segments of the controller.

848,016. ELECTRIC ALARM; Jacob R. Donnenworth, Lacombe, Alberta, Canada. App. filed March 2, 1906. A form of mechanical circuit-closing device comprising a rod adapted to be moved by the foot of the bank cashier and actuating a circuit-closing device.

848,028. ELECTRIC SWITCH; Gerald W. Hart, Hartford, Conn. App. filed June 25, 1906. Switch adapted to be secured to the ceiling which will be removable and safe from short-circuiting or arcing. Has a rotatable switch arm and an oil-containing receptacle in which the switch arm moves.

848,035. TROLLEY WIRE SLEEVE; Charles W. Ketteman, Dayton, O. App. filed Oct. 29, 1906. Form of trolley wire sleeve adapted to be quickly attached to the disengaged ends of a trolley wire and temporarily connect the same. Has gripping rollers with serrated edges to tighten the wires in the device.

848,045. LIGHTNING ARRESTER; James H. Pearson, Bloomfield, Ind. App. filed Jan. 9, 1906. A lightning arrester adapted to be compactly contained in a rectangular casing. Has a pair of cavities containing mercury, which is expanded by the heavy lightning discharge so as to temporarily close a ground connection.

848,047. ELECTRIC-CABLE SPLICING AND DISTRIBUTING BOX; Henry E. Procunier, Oak Park, Ill. App. filed Feb. 6, 1905. The wires of the distributing box lead upwardly from a pipe at the bottom thereof, which is sealed by paraffine poured therein. The front of the box is removable so as to expose the wires for the purpose of making the connections.

848,068. SIDEWALK CONDUIT; John B. Thacher, Albany, N. Y. App. filed Oct. 6, 1904. The sidewalk is constructed with U-shaped troughs of concrete, with laterally projecting studs therein on which the telephone cables are supported. The troughs have a hinged cover plate in the sidewalk by which the cables are exposed.

848,073. MODULATING TELEPHONE-RECEIVER; Kelley M. Turner, New York, N. Y. App. filed Jan. 13, 1906. A device by which the sensitiveness of an ordinary telephone receiver can be adjusted to any desired value or degree of loudness by merely moving a projecting lever or arm thereof. This arm has a cam device for pressing a rubber pad against the diaphragm so as to deaden the vibrations thereof.

848,083. ELECTROCAPILLARY DETECTOR AND RECORDING APPARATUS; James T. Armstrong and Exel Orling, London, England. App. filed Aug. 31, 1904. Has mercury tubes with their lower ends immersed in cups containing dilute acid. Connections are provided by which one mercury tube conducts a positive electric charge, while the other has a negative charge.

848,085. SPRING CLAMP FOR ELECTRIC TERMINAL WIRES; Horatio J. Brewer, New York, N. Y. App. filed Aug. 7, 1906. A form of wire cleat connection for batteries and the like. Has a piece of spring wire bent to form two engaging loops, between which the terminal wire is received and clamped.

848,117. PROCESS FOR THE PRODUCTION OF AN INSULATING MATERIAL FOR ELECTRICAL PURPOSES; Johannes Meyenberg, Baar, near Zug, Switzerland. App. filed Dec. 4, 1905. The process of producing insulating material which comprises subjecting animal filaments to fermentation, then treating with an alkaline lye, precipitating the natural cements by a coagulant, removing resultant liquid therefrom, then mixing the residue, and finally shaping the same.

848,120. AUTOMATIC TRUNKING DEVICE AND SELECTIVE SIGNALING APPARATUS; August A. Monson, St. Paul, Minn. App. filed Nov. 27, 1906. Relates to mechanical details of an automatic telephone exchange having magnets adapted to operate the keys of the subscribers' lines.

848,138. BLEACHING CABINET; Wilmont E. Strong, Tacoma, Wash. App. filed June 1, 1906. Form of flour bleaching apparatus, having a cabinet containing electric cells which produce the fumes used in bleaching flour. Includes separate slides by which the connections between the cells can be closed.

848,148. CIRCUIT-BREAKER; Albert C. Woehrle, New York, N. Y. App. filed June 16, 1906. A circuit-breaker for induction coils designed to be noiseless in operation. Instead of an ordinary pivoted vibrator there is employed a coil spring which moves when magnetized to separate from a contact point without shock or jar.

848,153. ELECTRICAL BLASTING MACHINE; Lucien W. Bowman, Reading, Pa. App. filed April 25, 1906. A rectangular box contains compartments having dry batteries therein, together with a belt which constitutes a potential terminal, and with which one of the circuit wires is engaged when it is desired to produce a blasting current.

848,163. ELECTRIC HEATING; Samuel S. Eveland, Philadelphia, Pa. App. filed Sept. 13, 1904. A form of press having substantially the form of a sensitive drill. The electric current is passed through the spindle and work support so as to weld the parts which are being rotated and pressed together.

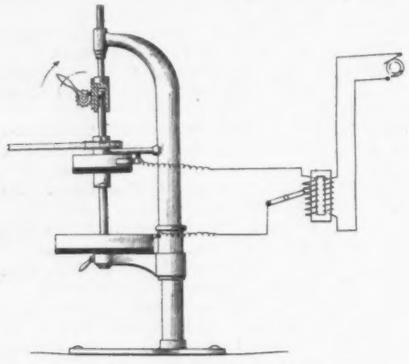
848,182. BRUSH HOLDER FOR MOTORS AND GENERATORS; John Lindall, Boston, Mass. App. filed Aug. 18, 1905. Brush-holder specially designed for large electric motors using heavy currents. Provides means by which the brushes are subjected to a direct force by a spring, whose tension is substantially constant in all positions of the brush, and which can be quickly and easily removed for replacement or repair.

848,197. RAILWAY TIE; Parshall D. Nichols, dec'd (E. A. Nichols, administratrix), Edgeworth Borough, Pa. App. filed Dec. 11, 1905. A crosstie for rails, consisting of a wire section having one of its

members spread laterally to fork the base plate, and having portions of its opposite members spread laterally to form sides for the rail.

848,221. TELEGRAPHY; John C. Barclay, New York, N. Y. App. filed March 19, 1906. In a telegraph system, the combination with a plurality of transmitting sets for different lines, each set comprising two transmitters, for currents of different polarity respectively, of an alternating-current generator, distributing means controlling the supply of current therefrom to said transmitters, and commutating means for each set of such transmitters operated synchronously.

848,256. LOCK FOR RAILWAY TRUCKS; Cornelius Maaskant Waterval Boven, Transvaal. App. filed Nov. 27, 1905. A magnet operated lock for freight car doors, the circuit of which is adapted to be completed from a switchboard located at a place on the car known only to authorized persons. The switchboard contacts are also concealed by having a bank of segments, only one of which is in the circuit.

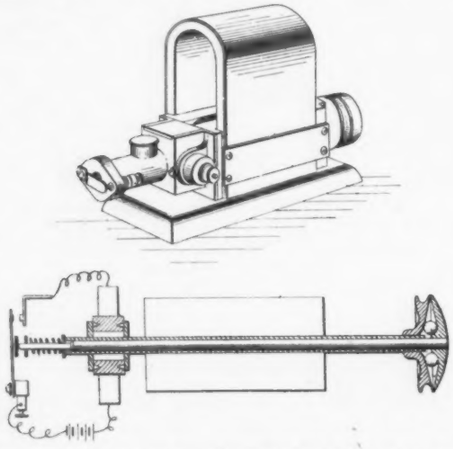


848,163.—ELECTRIC HEATING.

848,283. SWITCHING DEVICE; Jules A. Birfield, Rochester, N. Y. App. filed Feb. 13, 1905. In a telephonic switching device, the combination with an operator's key, of a plurality of selective keys, switch mechanism for each selective key, independent switch mechanism for said operator's key, said independent switch mechanism forming means for locking said operator's key upon actuation thereof, and means upon actuation of one of said selective keys for automatically causing the restoration of said operator's key.

848,292. AUTOMATIC SPEED-CONTROLLED CIRCUIT-CLOSURE FOR ELECTRIC GENERATORS; Charles E. Dawson, Indianapolis, Ind. App. filed Aug. 11, 1906. In order to automatically open the circuit of a magneto generator, except when it is in operation; patentee has a pair of concave disks containing balls which fly outward by centrifugal force, thereby separating the disks and moving a rod to close the circuits.

848,293. SYSTEM FOR OPERATING SWITCH POINTS AND SIGNALS; Albert Descubes, Paris, France. App. filed Aug. 27, 1904. An interlocking system for railroad switches and signals, adapted to work the switches and signals by means of two levers, each of which corresponds to one of the ends, by which a train can enter or leave a protected zone of the road.



848,292.—AUTOMATIC SPEED CONTROLLED CIRCUIT-CLOSURE FOR ELECTRIC GENERATORS.

848,326. SAFETY FUSE; Edward Steinmann, Bettendorf, and Joseph W. Schpendelen, Davenport, Ia. App. filed Oct. 10, 1906. A form of fuse particularly adapted for arc lights. The fuse cartridge is adapted to be received between spring clips. Has an opening in the side of sufficient dimensions to permit access to the interior and a frictionally retained movable cover for said opening. This permits of readily inserting new fuse wire in the cartridge.

848,372. ELECTRIC HOISTING SYSTEM; John D. Ihlder, New York, N. Y., and Rumsey W. Scott, Washington, D. C. App. filed July 29, 1905. A hoisting system for elevators, having, among other features, a detent which moves beneath the car and is displaced by an electro magnet when it is desired to lower the car.

848,382. OVERHEAD TROLLEY; Allen P. Lord and Nathaniel Wilkins, Bradford, Pa. App. filed Oct. 29, 1906. A U-shaped spring frame is supported by the axle of the trolley wheel, and has bent-over extremities which are adapted to close over the usual trolley conductor and hold the wheel against displacement therefrom. Has additional lubricating features.

848,398. AUTOMATIC-EXCHANGE SELECTOR; John G. L. Roberts, Chicago, Ill. App. filed June 18, 1906. Has multiple line terminals arranged in rows across an arc-shaped field, and means for rocking a switch to bring any selected terminal in connection with any desired line terminal of its corresponding row.

848,405. CURRENT CONTROLLING APPARATUS; August Sundh, Yonkers, N. Y. App. filed June 12, 1905. A form of switchboard for elevator systems having a floor controller and a main line switch and means for positively throwing said switch to prevent the car running beyond a predetermined limit of travel.

848,422. METHOD OF MAINTAINING OR INCREASING THE FLUIDITY OF MOLTEN OR SEMI-MOLTEN MATERIALS BY MEANS OF ELECTRICITY; Frank Wynne, Westminster, London, England. App. filed June 23, 1905. A method of heating a stream of red-hot molten or semi-molten material electrically while flowing from one place to another, said method consisting in causing a continuous electric current to flow through the entire falling portions of the stream.

848,473. INSULATING-CLAMP; Thomas B. Lee, Charlotte, N. C. App. filed May 15, 1906. Clamp designed to support power transmission cables on top of the usual petticoated insulators. Has a pair of inflexible sections adapted to clamp a transmission wire and engage the neck of an insulator, and means for securing said sections together.

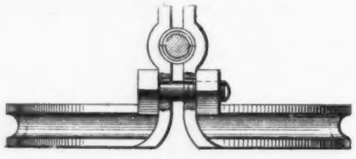
848,494. SPEED CHANGING MECHANISM; Louis Renault, Billancourt, France. App. filed April 28, 1904. Driving and speed changing mechanism for motor vehicles having a dynamo and a motor in co-axial relations, and a circuit controller for changing the torque and speed relations.

848,505. INTERLOCKING TERMINAL BASE; Louis Steinberger, New York, N. Y. App. filed June 18, 1903. A plurality of insulating blocks have rabbit edges so as to become interlocked together and form a built-up base of any desired size.

848,506. INSULATOR PIN AND SUPPORT THEREFOR; Louis Steinberger, New York, N. Y. App. filed July 24, 1905. An insulator pin formed of plastic composition with a central metallic core. The pin is molded in a special way so as to conform to the shape of the cross arm on which it is mounted.

848,507. UNDERGROUND ELECTRIC RAILWAY; Sylvester M. Sullivan, San Francisco, Cal. App. filed May 7, 1906. The usual trolleys are supported in an underground railway conduit, and the trolley wheels project upward from a depending plate or frame, being supported at the ends by spring-pressed pivoted arms thereon.

848,518. ELECTRIC MEDICAL APPARATUS; Carlos Van Bergh, Winnipeg, Manitoba, Canada. App. filed Dec. 1, 1906. Construction of motor having a commutator adapted to deliver a current during only one-half of each revolution, and means for retarding the armature during the remainder of each revolution. Causes a slow pulsating current in the motor circuit.



848,473.—INSULATING CLAMP.

848,519. INDICATOR; Chester Versteeg, Ashton, S. D. App. filed Nov. 14, 1906. An indicator for grain bins adapted to be displaced and close an alarm circuit when the grain is exhausted. A triangular box is held in an inclined position by the grain, but swings into a vertical position to close a circuit with an interior stationary arm when the grain is exhausted.

848,535. ANNUNCIATOR; David H. Coker, Piedmont, Ala. App. filed April 7, 1906. Construction of an annunciator whereby a signal may be transmitted from the office of a factory to notify an employee that his attendance is wanted. Provides for a return signal retransmitted back to the office to show that the calling signal has been received.

848,559. BATTERY-PLATE; William G. C. Krause, Waterbury, Conn. App. filed June 24, 1905. A battery-plate holder of the class described, comprising a pair of spaced back supports to engage the outer surfaces of the back of a plate, a front member hinged to said plate, and means to hold said members in a closed position to clamp a plate.

848,568. TELEPHONE-DETECTOR; Arnold R. Piehn, Alta Vista, Ia. App. filed March 31, 1906. In telephony, a circuit making and breaking means arranged in a talking-circuit, and serving to signal the number of a station breaking in to the receivers of connected subscribers.

848,570. ZINC ELECTRODE; Charles B. Schoenmehl, Waterbury, Conn. App. filed Nov. 16, 1905. An electrode, comprising a zinc having a reduced extension, a suspending-rod embedded in but protruding from said extension, and a hardened shoulder on said rod adjoining the end of the extension to engage the under side of the cover.

848,573. SUSPENSION DEVICE FOR ELECTRIC LAMPS; Campbell Smart, Swansea, England. App. filed Jan. 12, 1907. Automatic suspension gear for electric arc lamps, by which they may be suspended or raised or lowered. The lamp circuit is automatically broken when the lamp leaves its normal position.

848,600. PRODUCTION OF HOMOGENEOUS BODIES FROM TANTALUM OR OTHER METALS; Marcello von Pirani, Wilmersdorf, Berlin, Germany. App. filed Oct. 4, 1906. The method of producing homogeneous bodies of refractory metal, which consists in inclosing the metal in a suitable vessel, excluding air from said vessel, and directing cathode-rays upon said metal until it is fused and rendered homogeneous.

848,601. ELECTRIC TROLLEY RETAINER; Edward T. Platt, Chicago, Ill. App. filed May 21, 1906. The trolley harp has a pair of blades or shoes pivoted thereto, and projecting upward under spring tension, which guide the wheel on the wire, but which are depressed in passing hangers, etc.

848,610. OVERHEAD TROLLEY FROG; Burt Wilbur, Syracuse, N. Y. App. filed July 18, 1905. Has a form of switch point in the frog which is spring-pressed to guide the trolley wheel in one branch of the turn-out, so that the wheel always takes the path corresponding to that of the car.